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LETTUCE RESEARCH IN ARIZONA

Summary for 1959

Agricultural Experiment Station
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Table of Contents

NEW ARIZONA LETTUCE FROM BREEDING PROGRAM

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A new lettuce strain has been developed by The University of Arizona Horticulture Department and is hereby announced for release pending approval of The University of Arizona Pure Seed Advisory Committee.

The new selection named "Arizona Sunbright" was formerly grown and tested under the designation TBRC. It was derived by single plant selection for five generations and mass selection for four generations from Great Lakes (Regular). It has general Great Lakes characteristics, growth habit, and adaptability. Uniformity and yielding ability are good.

Plant is of medium green color and medium size. Leaves are broad, slightly savoyed and have a coarse ruffle but no serrations at the margin. Tips are turned downward slightly. Head shape is nearly spherical. Wrap is good; the cap leaf covers the entire top portion of the head with little or no turn-back (Fig. 1). Subtending frame leaves are erect and extend above the head providing protection from sun and wind. Butt of the head is round or convex, visible midribs are of medium thickness, and the cut surface of the core is medium large. Heads are medium large. In eight trials in three locations, 24 heads averaged 46 lbs. compared with Great Lakes Regular under the same conditions - 43 lbs.

The interior of the head is compact, greenish-white to white (Fig. 2). Internal core length is moderately short (4.4 cm - average of 192 measurements in 8 tests).

Average disease ratings from eight variety tests reveal that Arizona Sunbright lettuce has some apparent resistance to pink rib and russet spotting but is moderately susceptible to rib discoloration.

The principal advantage of this new strain as a spring lettuce for Arizona is its apparent resistance to tipburn. The strain has been developed by growing the crop to mature in late spring when normally tipburn is severe. In each progeny, selections were made for type and then heads were examined leaf-by-leaf. Only plants free of tipburn were saved for seed production. In early generations, individual plants were bagged so only seed arising from self-pollination was produced. Later generations were derived by mass production of seed from tipburn-free plants not bagged.

Since the lettuce was developed as a spring type, its performance has not been tested as a fall or winter crop.

The degree of tipburn resistance carried by Arizona Sunbright was checked in several ways. In the first test, three tipburn resistant strains were compared with four others in a trial on the U. of A. Yuma Experiment Station. This test, arranged in a 7 x 7 latin square, matured 15 April 1959 at a time when almost all commercial harvesting had been discontinued. Tipburn was severe in commercial fields and in portions of the test.

At maturity, 50 heads from each strain - replicate were examined leaf-by-leaf and the extent of tipburn damage rated according to the following scale: 1 = no tipburn, 2 = few exterior head leaves damaged and damage slight, 3 = moderate tipburn damage, 4 = severe tipburn, 5 = very severe tipburn damage throughout the head. Lettuce in classes 3, 4, & 5 would not be considered marketable. Table 1, below presents average ratings of the strains tested.

Table 1. Tipburn Ratings for Lettuce Strains.

Strain	Average tipburn rating
GL 118 *	3.35
Imp 749 *	3.60
UA Stock H **	3.57
UA Stock B **	3.31
TBR C ***	2.22
TBR D ***	2.31
TBR T ****	2.57

Difference required for significance at 1% level 0.11

* Commercial varieties in popular use.
** U. of A. breeding lines, H - Imperial type, B - Great Lakes type.
*** Tipburn resistant Great Lakes type.
**** Tipburn resistant Imperial type.

Subsequent tests were accomplished in the variety trial program conducted by the U. of A. Horticulture Department, the Agricultural Extension Service and cooperating commercial growers. Details of this program are given in another report. Arizona Sunbright was included in eight spring tests along with 35 to 37 other lettuce strains. In each test, data were obtained on the percent marketable heads harvested over a ten-day period. Following statistical analysis it was found that in each test there were a group of strains superior to all the rest in the important "percent marketable" or yield figure. The "top" group was not always made up of the same strains. Table 2 compares the average percent marketable figures for those varieties that were in the high yielding groups four or more times in the eight tests. Arizona Sunbright was surpassed significantly only by G. L. Premier, a strain no longer in popular use because of poor quality characteristics.

The incidence of tipburn was not high in these tests but still the average disease rating figures given in Table 2 for the same varieties in all tests demonstrate the tipburn resistance carried by Arizona Sunbright.

It must be understood that Arizona Sunbright does not show immunity to tipburn. It does have a valuable degree of resistance to the disease. Under severe tipburn conditions nonmarketable heads will be produced by the new strain. However, losses within this variety will be less than in other good-yielding types and under moderate disease conditions greater yields of high quality lettuce can be expected.

Since tipburn normally increases in severity as the Spring season progresses, Arizona Sunbright may be planted somewhat later than ordinary strains without additional concern regarding tipburn.

Seed of the new lettuce will be available from the Arizona Crop Improvement Association. Distribution stock will be advanced two generations (following the same strict selection procedure) from that tested as TBRC. The seed will carry common mosaic infection to the degree ordinarily found in Yuma-grown lettuce.

It is hoped that interested seed companies will place Arizona Sunbright lettuce into their programs for production of low-mosaic-content seed. Stock seed lots of this strain should be maintained by the same careful internal head examination procedure used previously. Detailed information on this method can be supplied.

Table 2. Performance of High-yielding Lettuce Strains in Spring Trials.

Strain	No. of times tested	No. of times in top-yield group	Average percent marketable*	Average tipburn rating**
Arizona Sunbright	8	6	54.8	1.6
Great Lakes 660	8	6	52.3	1.8
Great Lakes 366	8	5	52.4	1.9
Great Lakes 407P	8	4	52.8	1.8
Merit	8	5	54.1	1.9
Golden State D	8	5	56.1	1.9
Great Lakes 59	8	8	58.2	1.9
Great Lakes 428	8	6	58.4	1.9
Great Lakes Premier	8	8	65.6	1.8

* Over a 10-day harvest period.

** Based upon the scale, 1 = no tipburn, 2 = slight tipburn, 3 = moderate tipburn, 4 = severe tipburn, and 5 = very severe tipburn.

Figure 1. Arizona Sunbright lettuce.

Figure 2. The interior of Arizona Sunbright lettuce heads is uniformly compact, crisp, and white. The core is short.

EFFECTS OF A NEW SENESCENCE INHIBITOR ON LETTUCE STORAGE

by P. M. Bessey
Horticulture Department

As with most green leafy vegetables after harvest lettuce, too, shows its age by progressive yellowing of its leaves. This yellowing is one sign of senescence or degenerative breakdown of tissues and is usually followed by slime rots and other disease which live on dying tissues.

Vacuum cooling, plus refrigeration during transit and in retailing are the major factors effective in delaying the onset of senescence of lettuce under our present marketing practices. A new approach which may supplement these practices is provided by a new material, SD 4901*, which, when sprayed on lettuce in the field prior to harvest, helps the lettuce to retain its fresh green living condition for an extra three to five days after packing.

A test to demonstrate its effectiveness was set up December 14, 1959 with lettuce sprayed immediately prior to cutting and trimming for packing. Treatments were as follows:

1.	2.5	ppm in	100	gal.	per acre	water
2.	5.0	"	50	"		"
3.	5.0	"	100	"		"
4.	10.0	"	50	"		"
5.	10.0	"	100	"		"
6.	25.0	"	10	"		"
7.	Zero	"	100	"		"

Forty-eight heads with all their field wrapper leaves were sprayed for each treatment providing enough lettuce for duplicate cartons. The heads were then cut back and trimmed to five or six wrapper leaves and were packed in standard cartons according to the usual practices in commercial field packing.

The cartons were then placed in a controlled temperature storage room maintained at 60° F. This was done to accelerate senescence and more quickly evaluate relative effectiveness of the different concentrations and gallonages applied.

Beginning at seven days from the start of the storage period, intensive quality evaluations were made daily on six heads from each treatment. Ratings were given on marketability and amount of yellowing. Weights were taken as follows: Heads with all wrappers intact, leaves with yellowed areas, crushed leaves, leaves with pink rib, leaves with russet spot and finally, heads after all defects and butts were removed.

Lettuce treated with SD 4901 was maintained in a fresh green condition considerably longer than the checks. Statistically, differences favoring the SD 4901 treatment were highly significant equivalent to at least 99 chances out of 100.

*Experimental senescence inhibitor from Shell Development Co., Modesto, Calif.

There appeared to be a little difference between the five and ten ppm (parts per million) concentrations. Both were effective. At 2.5 ppm the effect was clearly less. Application rate of 100 gal. per acre was more effective than 50 gal. per acre indicating that coverage is important. Ten gal. per acre with 25 ppm was least effective of the series probably reflecting poor coverage as the cause. Some heads under this treatment seemed fully protected, but others not at all.

Subsequent to yellowing, leaf margins turned brownish, then black and slimy. These darkened areas were found to contain *Alternaria* and *Cladisporium* fungi and numerous bacteria, all of which live on dead tissue. After 10 days of 60° storage, all of the check treatment heads were covered with slime which followed yellowing into the heads.

Chart 1 shows marketability curves beginning at seven days for each of the treatments. In Chart 2, pounds of leaves which showed yellowing,per 24 head carton, are plotted against days in storage at 60° F.

Pink rib increased markedly with storage time, but was not influenced by the treatment applied. Russet spot was not related to any treatment or factor measured.

Retail weight, determined after crushed leaves were removed, however, was closely associated with position in the carton and the order of packing. This suggests that differences in crushing damage do occur in the packing operation. The relation between retail weight and treatment with SD 4901 was negligible, indicating that most, if not all, of the leaves influenced by SD 4901 were removed in the retail trimming operation.

Further ideas on the effects of SD 4901 on lettuce and methods for its application are under current test.

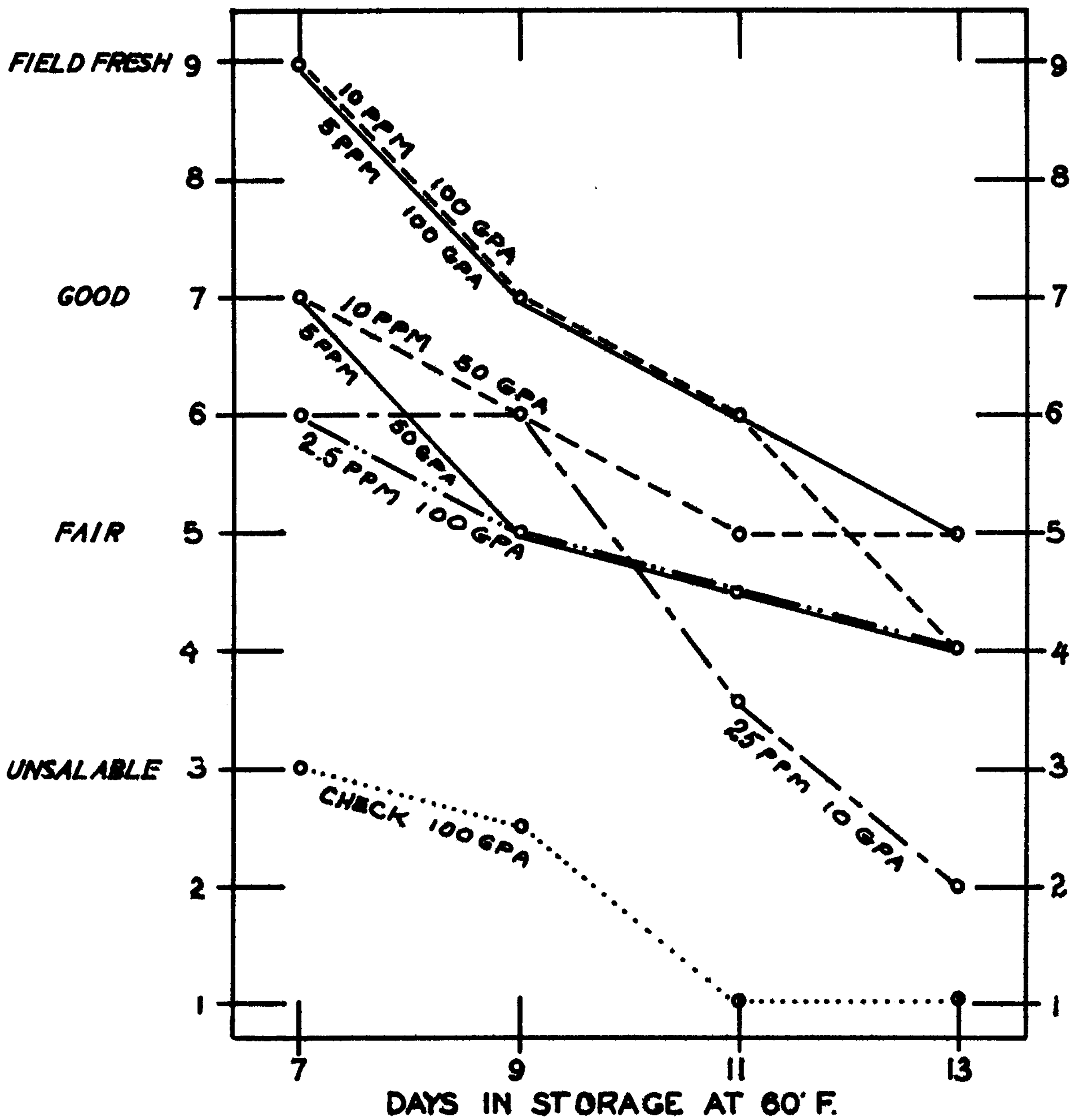

CHART I. MARKETABILITY OF HEAD LETTUCE AS AFFECTED BY TIME IN STORAGE AND TREATMENT WITH SD 4901.

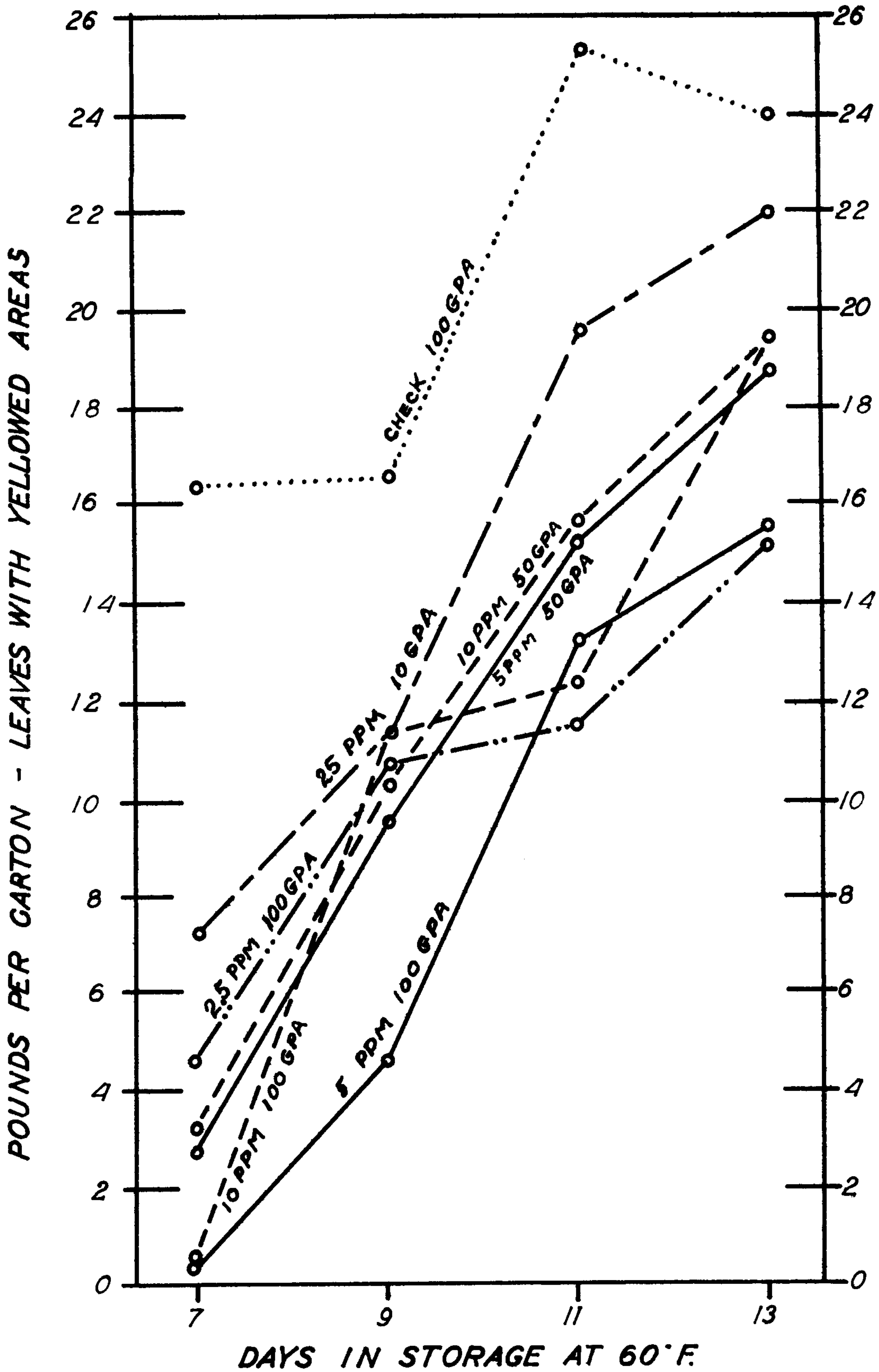

CHART 2. EFFECT OF SD 4901 CONCENTRATION AND GALLONAGE ON POSTHARVEST YELLOWING OF LETTUCE

POST-HARVEST STORAGE RELATIONS OF LETTUCE PINK RIB

by P. M. Bessey
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During the past two years at the Vegetable Research Laboratory in Mesa, a number of observations have been made and special studies conducted on the effects of storage environment on the development of pink rib in head lettuce.

This defect generally appears first in the basal midrib areas of wrapper leaves. It is often associated with tissue and cell separation which gives the appearance of pithiness. Bruised and crushed areas often become pink also. Pink rib may spread in the wrappers, but usually does not. The solid portion of the head is next affected with the pink progressing inward leaf by leaf. Here, particularly on hard mature heads, pink rib develops progressively into smaller and smaller veins. Late fall lettuce stored for eight weeks has developed pink rib on every leaf, right down to the core.

The defect is most severe in late fall and winter. It becomes less troublesome in spring. Late spring, summer and early fall lettuce seldom shows pink rib, except under prolonged cold storage conditions.

During the current 1959-60 winter season, reports of pink rib occurring in the field are common. Usually, however, pink rib is seldom found in the field, but appears during transit or in retailing, if it appears at all. In winter lettuce, it often takes as little as two or three days to show up.

In March, 1958, 12 cartons of pink-rib-free lettuce were brought into the laboratory for observation of downy mildew and stem gumosis storage behavior. The cartons were held for two weeks at 33 to 34° F. The lettuce was examined for several condition factors, including pink rib, which showed a trace in many of the heads examined. Equivalent cartons were then placed in six different storage environments as shown in Table 3.

Table 3. Effect of storage treatment and duration on the development of pink rib in lettuce, Mesa, March, 1958.

Pink Rib Ratings* in field	Pink Rib Ratings* after 13 days at 33-34° F.	Subsequent Storage Treatment	Pink Rib Ratings* at 8 days	Pink Rib Ratings* at 15 days
1.0	1.0	30 to 32° F.	2.0 (frozen)	2.0 (frozen)
1.0	1.7	33 to 34° F.	3.7	3.0
1.0	1.5	41° F.	2.5	3.0
1.0	1.0	55° F.	3.0	4.0
1.0	1.0	77° F.	2.0	(decayed)
1.0	2.0	Laboratory - 68 to 80° F.	2.0	(decayed)

*1.0 = none, 2.0 = trace, 3.0 = moderate, 4 = heavy, 5 = severe pink rib.

Six heads from each treatment were examined at each evaluation period.

Pink rib was found to have increased in all but one treatment following transfer of the cartons to the different storage environments. The 8-day rating suggested that low temperature, 33 to 34°, was more effective in causing pink rib, than higher temperatures. This condition was subsequently reversed by the 15-day rating. The lettuce which became frozen developed a trace of pink rib. Conceivably this could have developed prior to freezing. However, it did not change while frozen. After thawing, tissues were so badly damaged that pink rib could not be distinguished. Lettuce under the two high temperature treatments was probably under the influence of bacteria and saprophytic decay fungi by the 8th day so that pink rib symptoms showed little change.

Late in November, 1958, two more tests were conducted. They dealt with the relation of head maturity and amount of field trimming to market quality, carton weight and retail trim-out. A summary of these tests is presented separately in this special report.

Pink rib, however, occurred in these two tests with a vengence. Since it was rated on the solid portion of the heads only, its effect on wrapper leaves is not known. Despite differences in wrapper leaf count, pink rib on the solid portion of the head did not differ. The treatments also included both hard and firm heads, all selected from the same commercial field to represent two stages in maturity.

Not only did the hard, more mature heads show more pink rib at the end of the simulated transit period, but actually increased by an additional 48% as compared to 30% for the firm heads during the retail handling period. Fully one-third of the weight remaining when heads were trimmed for retail was of leaves which showed definite pink rib symptoms.

Another test to determine more clearly the relationship of storage temperature and duration to pink rib development was set up in April 1959.

Forty cartons of Great Lakes 428 head lettuce were cut from experimental plots at the Mesa Station. A light infection with powdery mildew was present, particularly on the outer leaves.

This lettuce was placed in storage at 35, 43, 50 and 59 to 60° F. Two replicates within temperatures were provided. Equal samples were removed from storage April 5, 11, 15 and 23. The remaining lettuce was evaluated April 30 since the 50 and 59 - 60° lettuce had all broken down. Samples were also removed periodically for Mr. George Sharples for determination of chlorogenic acid content. A summary of this study is presented separately in this report.

Differences in pink rib did appear in this test; however, the maximum attained was far less than in the previous tests and, in general, would be described as a trace. Data is shown in Table 4.

Table 4. Effect of storage temperature and duration on head lettuce pink rib development, Mesa, April, 1959.

Days from beginning of test.	Pink Rib Ratings* --- Storage Temperatures --- 35°F.	43° F.	50° F.	59 - 60° F.
0	1.0	1.0	1.0	1.0
7	1.1	1.4	1.7	1.5
11	1.4	2.1	2.1	Decayed
19	1.9	2.0	2.2	"
26	2.2	2.2	Decayed	"

*1.0 = none, 2.0 = trace, 3.0 = moderate, 4.0 = heavy, 5.0 = severe.

Powdery mildew became a serious condition factor at all temperatures and caused a loss of samples at both the 50 and 59 - 60° F. treatments. Despite this loss, differences in pink rib development were becoming apparent favoring the storage of lettuce at as low a temperature as could safely be maintained.

The next experiment was set up by Mr. John Nelson as a special problem within the teaching program of the department. It was conducted under the supervision of the author at the Vegetable Research Laboratory during June 1959. Objectives of this test were to more precisely evaluate pink rib temperature relations in a longer storage period and to determine the influence of packaging lettuce in polyethylene bags on pink rib development.

Great Lakes Regular lettuce was obtained from guard rows of a department variety trial conducted in the Willcox district in cooperation with the Extension Service and Martori Brothers Distributors.

Treatments were applied as shown in Table 5. Half the heads stored were placed in ventilated 4 mil polyethylene bags. In addition to rating evaluations, weights of leaves affected by pink rib were also taken.

Table 5. Effects of storage temperature and duration on pink rib development in packaged and unpackaged head lettuce, Mesa Station, June 1959 (Willcox lettuce).

Days in Storage	Pink Rib Ratings and Weights of Affected Leaves											
	33° F.				36° F.				41° F.			
	Open		Packaged		Open		Packaged		Open		Packaged	
	Rating*	Wt.**	Rating	Wt.	Rating	Wt.	Rating	Wt.	Rating	Wt.	Rating	Wt.
1	1.42	1.2	-	-	-	-	-	-	-	-	-	-
8	2.00	5.4	1.75	2.4	1.75	6.0	1.75	4.8	1.50	3.6	1.75	2.4
14	1.75	7.2	1.75	9.0	2.00	9.0	2.00	10.8	2.00	14.4	2.25	8.4
21	2.25	12.6	2.75	19.8	2.75	15.6	3.00	21.0	2.75	18.0	3.00	19.8
28	2.75	13.6	2.75	16.8	2.75	14.4	3.00	11.4	3.00	18.0	3.25	21.6

*Ratings for pink rib: 1.00 = none, 2.00 = trace, 3.00 - moderate, 4.00 = heavy, 5.00 = severe.

**Weight in pounds based on the weight of affected leaves per 50-pound carton of 24 heads.

Analysis of variance on the rating data indicated a significant progressive increase in pink rib with higher temperatures. Also, lettuce stored in plastic bags developed significantly more pink rib than when left unpackaged in cartons. The increase in pink rib with storage time was highly significant. Using weight values alone, differences between temperatures and between packaging conditions were not statistically significant.

Pink rib was one of several factors evaluated in measuring shipping quality in a series of 15 lettuce variety trials in 1958 and 1959. Between varieties, but small differences in pink rib development appeared. Statistically there were significant differences. These, however, could be due to differences in maturity which is recognized to be related to pink rib.

Seasonal differences were also apparent in these tests. Yet, some late harvested lettuce from higher elevation districts gave greater pink rib responses than earlier tests in the same area and elsewhere. This suggests again that from the cutter's standpoint, maturity may be the major controlling factor.

In summary, pink rib increased in severity with storage time, but developed more slowly the lower the temperature that was maintained. At all storage temperatures, except where decay took precedence, little difference in maximum pink rib development was found. Hard, mature lettuce developed more pink rib and developed it faster than firm, less mature lettuce. Lettuce packaged in polyethylene bags developed more pink rib than when stored in the usual carton pack. Winter-grown lettuce consistently showed more pink rib and sooner than lettuce grown at other seasons.

Further studies on this major winter market defect are under current tests.

EFFECTS OF MATURITY AND FIELD TRIMMING OF LETTUCE ON MARKETING CHARACTERISTICS

by P. M. Bessey
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On November 20 and 22, 1958* two tests were initiated on Salt River Valley head lettuce to determine how much reduction in carton weight could be obtained by lowering the number of wrapper leaves left on the heads. Further evaluations were made to learn whether fewer wrapper leaves had an adverse effect on market quality and retail trim-out weight per carton.

Heads of two maturities, hard and firm, were cut and trimmed to 8 wrapper leaves. From this lettuce 6, 4, 2, and 0 wrapper leaf count treatments were obtained by further trimming. Each head was inspected individually and none was packed which showed any defect. Packing was done in standard lettuce cartons (No. 7306) by the usual commercial procedures for a two dozen pack. Each treatment was replicated four times.

Cartons were vacuum cooled and weighed, then placed in the cold storage rooms at the Vegetable Research Laboratory in Mesa for simulated transit and retail holding periods.

At the end of seven days storage at 36 to 38° F., heads from one-half of each carton were removed and examined. The remaining half carton was then placed in a 49 to 50° F. storage room for an additional five days.

All heads were rated and weights taken for the following condition factors: decay, russet spotting, tipburn, rib breakage and bruising, pink rib and other rib discoloration. Also determined were retail trim-out weights and head weights when all head defects were removed including marketable defects.

The average reduction in carton weight for each pair of wrapper leaves removed per head was 4.8 pounds in the first test and 4.6 pounds in the second. Based on both tests, this is equivalent to 2.35 pounds reduction in carton weight for a single wrapper leaf removed from each of the 24 heads. Comparable weight reductions are shown in the accompanying chart based on data from the second test.

Retail weight determined by removing damaged wrappers and usually the cap leaf as well and by trimming the butt showed essentially no effect of differing wrapper leaf count. Cartons of firm heads yielded three to four pounds less than hard heads as shown in the same chart.

Only two condition factors were significant at the end of the simulated transit and retail holding periods, (1) rib breakage and bruising and (2) pink rib and other rib discoloration: otherwise termed for these two tests as crushing and pink rib. These defects were evaluated on the solid portion of the head only, and showed no apparent effect of varying wrapper leaf counts. In other words, total crushing and pink rib defects, separately and together were essentially no different whether lettuce was packed with eight wrapper leaves or was stripped to the cap leaf. Firm lettuce showed slightly less crushing and pink rib than hard lettuce at the end of the simulated transit period. However, the additional five days at 49-50° simulating the retail holding period gave an increase of 48% in pink rib in the hard lettuce, but only 30% in the firm lettuce.

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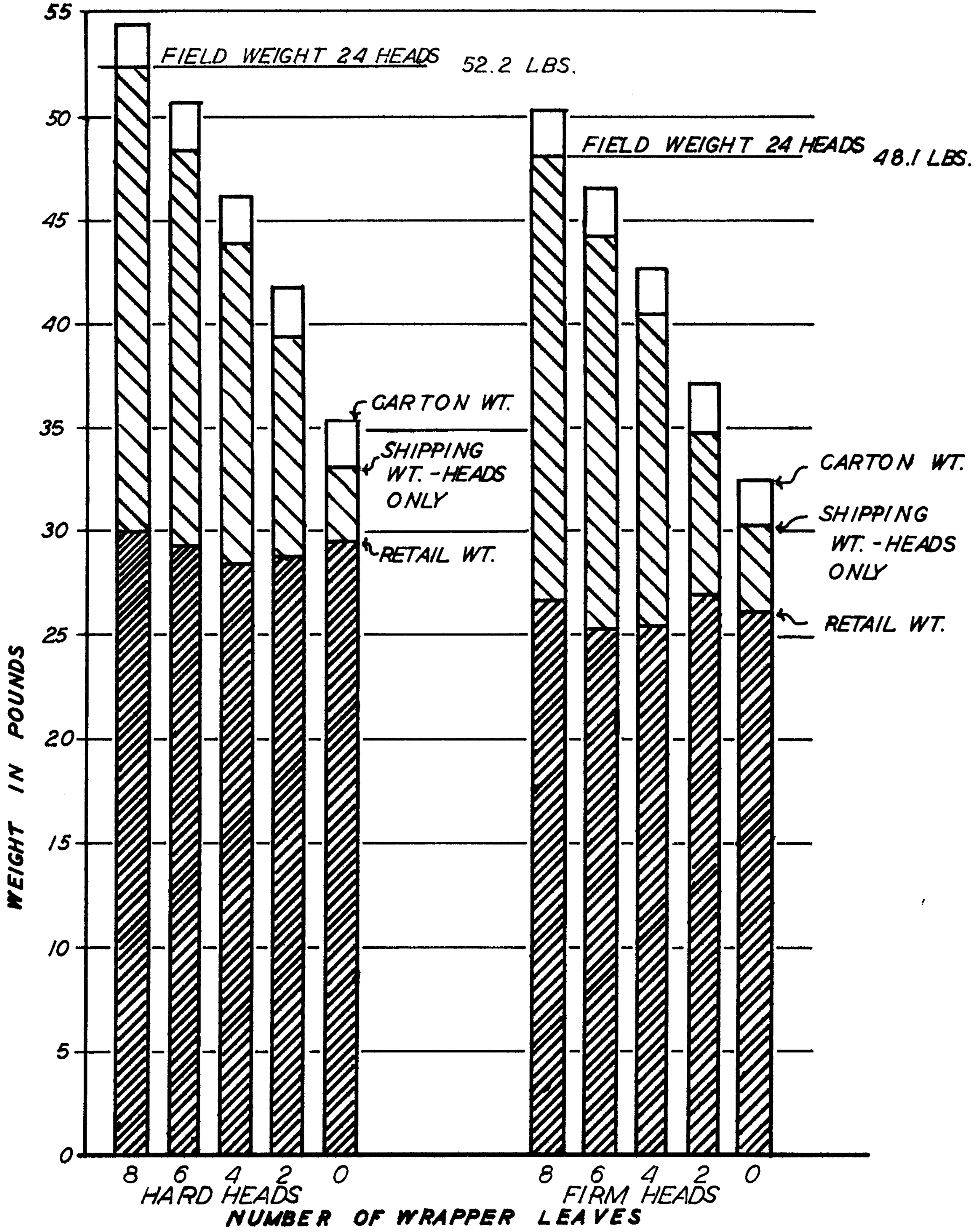
*At the same time, the initial pair of a round-the-year series of USDA conducted shipping weight tests with closely allied objectives was prepared and lettuce shipped to New York City for evaluation by USDA personnel. Lettuce for both sets of tests was packed in the fields of the Earl C. Recker Co. of Mesa and was paid for by the Arizona Vegetable Growers Association of Phoenix.

In summary, with Salt River Valley fall lettuce, for each wrapper leaf removed per head before packing, carton weight was reduced by 2.35 pounds. Retail weight was not materially affected by change in wrapper count, nor was market quality as measured on the solid portion of the head in terms of crushing and pink rib. Firm lettuce showed less crushing and pink rib than hard lettuce and under simulated retailing conditions, developed far less pink rib than hard lettuce.



THE EFFECT OF LETTUCE WRAPPER LEAF REDUCTION ON SHIPPING WEIGHT AND RETAIL WEIGHT

THE POLYPHENOL CONTENT OF LETTUCE TISSUE

by G. C. Sharples and P. M. Bessey

It is known from previous studies that polyphenolic compounds are present in the cells and latex of head lettuce leaves and stems. The oxidation of polyphenols in the presence of the proper enzymes by atmospheric oxygen leads to the formation of red or brown pigments, called quinones. These can further condense or polymerize to form insoluble and inert red or brown substances which deposit in the cells. Such reactions may occur in the midrib of mature head lettuce leaves and lead to the conditions known as pink rib and rib discoloration.

Chlorogenic acid, a polyphenol which occurs widely in plants, has been intensely studied in relation to discoloration and browning in many plant tissues. Alcoholic solutions of chlorogenic acid have the property of absorbing ultraviolet light strongly at a wavelength of 320 millimicrons. A comparison of the ultraviolet absorption spectra of solutions in question with those of solutions containing known amounts of authentic chlorogenic acid thus provides at once a tentative identification and a means of measuring its concentration.

A lettuce storage experiment in progress during April, 1959, to study the development of pink rib at different storage temperatures was used to determine whether chlorogenic acid tends to accumulate in the tissues in relation to the appearance of pink rib. Mature heads of Great Lakes Regular were harvested at the Mesa Experiment Station April 3, placed in standard shipping containers and stored at temperatures of 34° F., 43° F., 48° F., and 60° F. for a period of 2 weeks.

Six heads were selected at random from each lot at the beginning of the storage period and again after 6 and 14 days of storage. A longitudinal section of each head, weighing 100 grams was homogenized in a blender with 150 milliliters of ethyl alcohol for 5 minutes. One milliliter portions of the filtered mixture were diluted to 250 milliliters. The percent ultraviolet transmittance of these solutions was measured at a wavelength of 320 millimicrons as compared to the transmittance of water taken as 100%. The results are shown in Table 6.

Table 6. Percent Ultraviolet Transmittance of Alcoholic Tissue Extracts of Great Lakes Head Lettuce in Relation to Pink Rib Development

Storage Temp., °F.	0 Days % Trans.	Pink Rib	6 Days % Trans.	Pink Rib	14 Days % Trans.	Pink Rib
34	95.2	0	98.2	0	98.3	0
43	96.3	0	99.4	Trace	99.8	Trace
48	96.0	0	99.7	0	99.2	Trace
60	96.1	0	99.8	Trace	ALL DECAYED	

Since there was no sizeable reduction in the amount of light transmitted by the different solutions, it is concluded that chlorogenic acid does not occur in measurable amounts in the leaves of mature, freshly harvested Great Lakes lettuce. Since significant amounts of pink rib did not develop in the lots of stored lettuce it was not learned whether this polyphenol accumulates in infected leaves.

Additional tests were conducted in which localized areas of pink rib infected tissues were removed from leaves to determine if chlorogenic acid or similar ultraviolet absorbing polyphenols might be concentrated in those areas.

It is probable that the ultraviolet absorption method as used cannot detect the presence of chlorogenic acid in amounts less than about 100 ppm in the fresh lettuce tissue. Instrument readings obtained in all the tests suggest amounts less than this. It is further concluded, therefore, that chlorogenic acid occurs in amounts too small to measure or that the colored compounds in the tissues are derived from other unknown polyphenols.

WEED CONTROL IN LETTUCE

by W. D. Pew
Horticulture Department

Although the use of herbicides has become a rather widely followed practice, some special problems do exist in their use. This has been particularly true where CDEC (Vegadex) has been applied to control weeds in lettuce.

The chief problem appeared related to or associated with the influence of CDEC (Vegadex) on seed germination and stand establishment rather than the final production. On several occasions, poor germination and/or poor stands, supposedly resulting from an application of CDEC (Vegadex) have been reported by commercial growers. In following up these reports, it has been found that other cultural factors could have had as much, or more, influence on the germination and emergence of the lettuce than did Vegadex. Investigating further into the possible causes of the difficulties revealed that in many of these reported cases excessive temperatures, as well as either excessive drying or wetting of the lettuce beds, could have markedly contributed to the problem of poor stand. With the possibility that other factors may be playing a definite roll in poor germination and emergence, a complete evaluation of the weedicide, CDEC (Vegadex), was necessary to get a complete measure of its limitations and possible influence on newly planted lettuce.

The data tabulated in Table 7 show that CDEC (Vegadex) can have, under certain conditions, an early detrimental effect on seedling lettuce. However, the data also show that the usual depressing influence is overcome rather quickly and disappears almost entirely by harvest time. Yet, the fact remains that CDEC (Vegadex) applied after planting, but several days ahead of the germination irrigation, does depress germination and emergence. Fortunately, this is not a commercially accepted practice and should not enter into the problem confronted by the grower. That is to say, growers normally apply the germination irrigation as soon after planting as possible.

Table 7. Influence of time interval following the application of CDEC (Vegadex) and the germination irrigation on lettuce seed germination, seedling emergence and yield of fall-grown lettuce.

Treatment1/	Stand2/ Count	Stand3/ After Thinning	Stand3/ Prior to Heading	Total 1st Cut	Total 2nd Cut	Total Yield by Sizes Expressed in Doz./Carton 1-1/2	2	2-1/2	Total
4 Days	49	76	72	132	401	128	280	125	533
3 Days	61	82	78	211	427	187	337	114	638
2 Days	69	82	80	218	451	182	372	115	669
1 Day	76	83	80	219	425	188	326	130	638
0 Days	79	83	79	193	465	153	382	123	658
Check	92	84	79	273	442	245	358	112	715
4 Days & Sprinkle	50	82	82	173	432	131	342	132	605
1 Day & Sprinkle	63	84	82	200	482	185	362	135	682

All seed was planted 4 days prior to irrigation.
1/ Days between weedicide application and initial irrigation.
2/ Seedling count for 10' of row before thinning.
3/ Seedling or plant count for plot (108 feet of row).

These data also show that where the field is watered the same day, or the day following the herbicide application, no appreciable reduction in germination or emergence has been found.

In reviewing the figures in Column 1, Table 7, (seedling count), there appears to be a linear relationship between time lapse and number of seedlings pointing out that the longer the wait between application of the herbicide and the germination irrigation, the greater will be the influence of CDEC (Vegadex) on reducing the number of lettuce seedlings. A review of the yield data in Table 7 show that the check plots produced highest yields, but not much greater than for the other treatments, except treatment No. 1, which was the poorest. Part of this reduction in yield undoubtedly was the result of the thinner stand created by an inadequate number of seedlings prior to thinning.

The use of simulated rainfall (sprinkling) did not appear to influence the final thinned stand or yield even though the number of pre-thinned seedlings had been markedly reduced. As noted in Table 8, the sprinkling treatment (simulated rainfall) not only reduced the number of seedlings which came up, but also reduced the number of plants after thinning. This reduced thinned stand was undoubtedly the chief reason for the lower total yield received from the plots of this treatment. All other treatments appeared rather similar as measured in terms of total yield. A comparison of the data in the columns showing yields for the first and second cuttings, indicate that only the granular form of CDEC (Vegadex) delayed maturity.

Although CIPC at 5 pounds per acre gave a slightly higher yield than the other treatments, the weed control value was poorer, in general, than for CDEC (Vegadex). From this point of view, its value appears to be limited as an herbicide in commercial lettuce production. A combination of CDEC (Vegadex) and CIPC was used in an attempt to get a wider range of weed kill. However, as shown in the data, the use of this combination showed no advantage in achieving this end. Likewise, using either CDEC (Vegadex) or the combination of CDEC (Vegadex) and CIPC applied at night had no advantage. This would indicate that temperatures, as reduced under night conditions during the fall of the year, neither improved nor impaired the effectiveness of these materials. If temperature plays a part in altering the value of these weedicides, as has been suspected, there must be other factors associated with it.

A general evaluation of the data in Tables 7 and 8 show that CDEC (Vegadex) can be used safely and effectively as an herbicide in lettuce. The reduction in germination and seedling emergence probably will be limited where CDEC (Vegadex) is used. A delay in seed germination and seedling emergence resulting from waiting too long between herbicide application and the germination irrigation, as well as the influence of rainfall following the herbicide application are rather temporary in nature and are soon almost entirely overcome by harvest time. The combination of CDEC (Vegadex) and CIPC performed no better than CDEC (Vegadex) applied separately.

Table 8. Influence of CDEC (Vegadex) and CIPC as herbicides on germination, emergence and yield of fall-grown lettuce.

Treatment[1]	Stand[2] Count	Stand[3] After Thinning	Count[3] Prior to Heading	Total 1st Cut	Total 2nd Cut	Total Yield by Sizes Expressed in Doz./Carton 1-1/2	2	2-1/2	Total
1. Check	69	90	85	131	548	87	404	188	679
2. Vegadex 5#/Acre	44	83	78	179	455	116	364	154	634
3. Vegadex 5#/Acre + Sprinkle	30	76	73	226	350	133	293	150	576
4. CIPC 5#/Acre	54	86	82	209	487	134	396	166	696
5. Vegadex 3#/Acre + CIPC 2#/Acre	46	83	82	182	498	144	387	149	680
6. Vegadex Granular 5#/Acre	55	86	82	114	542	128	380	148	656
7. Vegadex 5#/Acre Appl. at Night	43	80	77	204	426	136	350	144	630
8. Vegadex 3#/Acre CIPC 2#/Acre at Night	42	84	82	207	453	134	362	164	660

1/ All applications made preplant.
2/ Seedling count for 10' of row.
3/ Seedling or plant count for plot (108' of row).

EFFECTS OF VARIOUS PLANT NUTRIENTS AND THEIR SOURCE ON LETTUCE PRODUCTION

F. Turner, Jr., Department of Agricultural Chemistry and Soils
B. R. Foerman and L. F. True, Assistant Agricultural Agents, Maricopa County

The investigations were conducted on the Mary E. Farms of Steve Moratori in the Harquahala Plains. Fertilizer treatments and the yields, together with fertilizer costs, are shown in the following table. Mosaic-tested G. L. R-200 lettuce seed was planted August 19, 1959. Side-dress treatments were applied September 24 and October 23. Only one cutting, on November 17, was made due to lateness of the season and age of the lettuce, but the yields of this cutting are believed to be proportional to the total expected yields.

Although ammonium sulfate was also used as a nitrogen source in combination with the various phosphate sources, the stand was so drastically reduced where this material had been banded at planting time that the plots where it was used could not be compared.

Ordinary (single) superphosphate, when broadcast prior to disking and bedding, was very significantly the best source of phosphorus used in these trials. Similarly, ammonium nitrate was a much better source of nitrogen than was calcium nitrate, where both were the only sources of this element which were applied in these studies.

Comparisons of other source materials and times of application are shown in the table.

Table 9. Effects of phosphate and nitrogen sources and the times of their application on fall lettuce--Harquahala Plains, 1959. One cutting.

Treatment[1]		Cartons per Acre	Percent of Best Treatment	Fertilizer cost/acre
O. S. P.	600, 0, 0, 0	244	100	$38.76
A. N.	150, 150, 150, 150			
16-20-0	150, 150, 150, 150	175	72	40.21
A. N.	0, 104, 104, 104			
T. S. P.	260, 0, 0, 0	174	71	36.98
A. N.	150, 150, 150, 150			
T. S. P.	65, 65, 65, 65	116	48	36.98
A. N.	150, 150, 150, 150			
O. S. P.	150, 150, 150, 150	106	43	53.42
C. N.	306, 306, 306, 306			
O. S. P.	150, 150, 150, 150	106	43	38.76
A. N.	150, 150, 150, 150			
16-20	400, 67, 67, 67	93	38	40.21
A. N.	0, 104, 104, 104			
T. S. P.	65, 65, 65, 65	64	26	51.64
C. N.	306, 306, 306, 306			
16-20-0	150, 150, 150, 150	58	24	48.28
C. N.	0, 216, 216, 216			
No Fertilizer		10	4	0.00

L.S.D. 23 (at 5% level), 32 (at 1% level)

(1) Phosphate sources: ordinary superphosphate (O. S. P.), treble superphosphate (T. S. P.), and ammonium phosphate--sulphate (16-20-0)
Nitrogen sources: ammonium nitrate (A. N.) and calcium nitrate (C. N.), and 61-20-0
Applications listed as lbs/acre of the source material broadcast before bedding, banded at planting, side-dressed after thinning, and side-dressed at start of head formation.

LETTUCE INTERNAL STEM DISCOLORATION

by R. B. Marlatt
Plant Pathology Department

FUNGUS

Lettuce from the North Gila Valley area near Yuma showed symptoms of an internal stem discoloration. Vascular areas of the stem were blackened and cavities were found in the stem pith containing brown, solidified latex. When cut, the stem exuded copious amounts of latex and solidified latex was found on heart leaves. Non-septate, intercellular, hyaline mycelium was found in the stem pith adjoining the brown cavities. Amber or brown discoloration often occurred where the hyphae were numerous. Hyphae penetrated adjoining cells and what first appeared to be haustoria enlarged and developed into thick-walled spores. These spores looked very much like oospores.

Diseased stems were disinfected and then were aseptically pared to the vascular areas, a slice being removed for microscopic examination which confirmed that they all contained the fungus. Several pared stems were placed in sterile, numbered jars and incubated to see if the fungus would grow. Sections of disinfected, pared stems were also cultured on water agar in another attempt to isolate the fungus.

Some stems were placed in small loosely-capped jars in larger jars containing about half a cup of water and then held at 55° F in another attempt to cause the infecting fungus to sporulate on the surface.

Other stems were separately macerated with water and each suspension placed on a lettuce plant. The plants and soil were contained in half-gallon paper cylinders, covered with a plastic bag. Greenhouse conditions were favorable for downy mildew sporulation for about 2 weeks.

RESULTS

The fungus did not grow to the surface in any of the incubation or culture tests and therefore could not be positively identified. No downy mildew resulted from inoculation with macerated stem tissue.

BACTERIA

Stems and taproots of lettuce specimens were received October 20 from Kansas Settlement near Willcox. Some of the mature plants were wilting. In cutting longi-sections of the plant, a discolored area was found in the stem. Often the stem vascular ring was red; the stem pith was watersoaked above and brown, sometimes hollow, where it joined the taproot. Most of the taproot was normal and the head appeared normal except for wilting. No excessive latex was seen.

Inoculations: When the diseased plants had been received, the stems were immediately surface-sterilized and plated on potato dextrose agar. Cultures were purified and four bacterial colonies and one mold were saved. The organisms were used in an experiment consisting of ten treatments randomized in four replications.

Broth cultures were injected into lettuce stems March 12 and April 2 and 24. Control plants received injections of sterile broth. At the same time the soils in some pots were inoculated with cultures. Soil was inoculated by removing buried test tubes and pouring the inoculum into the holes; controls received sterile broth.

On May 7 stems and taproots were split longitudinally and rated for internal stem and root discoloration.

Soil Transmission: Soil was obtained from fields in Kansas Settlement where lettuce had died of a stem and root rot which may have been the last stages of internal stem discoloration. Half of the soil was steam pasteurized. The unpasteurized and pasteurized soils were planted to lettuce in greenhouse pots. Roots of plants in the pots were injured by thrusting a lettuce knife down to the bottom of the pot near its periphery. When they had matured, plant roots and stems were split longitudinally and rated for any discoloration as in the inoculation experiment.

RESULTS

Inoculations: Only one organism, a bacterium, caused significantly more internal stem discoloration than the control. The discoloration was very slight as compared to the field disease and may or may not be related to it. The culture is being saved for identification. No soil inoculations resulted in any significant discoloration and practically no root discoloration occurred.

Soil Transmission: There was very little stem discoloration and practically no root discoloration in plants grown in Kansas Settlement soil. Pasteurizing the soil did not lessen the discoloration.

DOWNY MILDEW DISEASE CYCLE

by R. B. Marlatt
Plant Pathology Department

Before a better mildew control can be devised it will be helpful to know the length of time elapsing between field infection and sporulation. If lettuce is infected at an early age and sporulation is delayed until climatic conditions are favorable, early spraying may be needed. If most infection occurs only during an epiphytotic, spraying can be delayed until early signs of the disease appear. Such epidemiological studies will probably be of more lasting value than routine fungicide trials.

Collection of Samples: In order to know when lettuce became infected, 48 plants were collected periodically from several fields scattered over the Salt River Valley. They were kept alive for three weeks in a greenhouse where the climate was conducive to mildew sporulation. If no signs of the fungus were found during this time, they were considered to be disease-free.

Sterile technique was used whenever necessary. Before handling the first plant and after completing the handling of each plant thereafter, hands and trowel or spade were washed with a fine spray of disinfectant. Small plants were lifted with a trowel and transplanted to malt cups, and as they grew larger, to half-gallon ice cream containers. They were immediately covered with an inverted plastic bag which was sealed air-tight to the container with a rubber band. When it became necessary, gallon size ice cream containers were used and a trenching spade replaced the trowel.

Greenhouse Incubation: The plants were subjected to 48 hours of darkness under a black plastic tarp set on a frame over one of the greenhouse tables. After this period, they were returned to the full light of the greenhouse. The greenhouse was operated as nearly as possible at a temperature of 55° F and a relative humidity of 90%.

In order to determine that temperature and humidity conditions favorable to sporulation existed in the greenhouse through the period of this experiment, controls of inoculated plants were grown; these developed mildew satisfactorily.

RESULTS

Mildew: None of the collected plants developed mildew and none was seen in the fields. Sclerotiniose and slime were occasionally found, especially in older plants. Sclerotiniose was often severe after the moist period in the greenhouse in older plants that had shown none when collected. Collection of plants and holding in a cool, humid greenhouse might provide a good means of estimating a field's sclerotiniose potential.

Temperatures: Greenhouse temperatures were kept much more constant than those in the field. Field air temperatures were recorded by a Friez recorder which was placed in a wooden box near a lettuce crop on the Mesa Farm. The box was resting on its side to shade the instrument and was coated with aluminum paint to reflect heat.

In early February greenhouse minimum temperatures averaged 15° F above the field minima and maxima were kept an average of 8° below those in the field. During early March there was a greater difference (17°) between greenhouse and field maximum temperatures. As field temperatures increased the differences increased; in early April it was possible to keep the greenhouse maxima approximately 23° below the rising field maxima. Greenhouse weekly means ranged from a low of 55° in January to April's high of 62°, or an increase of only 7°; whereas, field weekly means ranged from January's low of 53° to April's 73° high, or an increase of 20° F.

EFFECT OF SOIL FUNGICIDES ON BIG VEIN

by R. B. Marlatt
Plant Pathology Department

Since 1955, this laboratory had studied the possibility that big vein was not caused by a soil-borne virus but was due to a minor-element deficiency. Failure to find the proper element may be explained by R. G. Grogan's recent work showing that it is probably caused by a fungus, Olpidium brassicae. Our approach has now been changed to an evaluation of methods for controlling the fungus.

Big-vein disease was severe and evenly distributed in 1957-58 in Field A, Borders 19, 20 and 21 on the U. of A. Farm. These borders were therefore chosen as the site for the 1958-59 experiment.

Counting control plots, there were seven treatments replicated four times in a randomized block design.

The liquid fumigants were injected with a tractor-mounted pressure applicator to a depth of 7 inches at 1-foot intervals, except that Vapam was applied at a 6-inch spacing. Soil was sealed with a loose-ring cultipacker immediately following injection.

After surface application or injection precautions were taken to avoid transferring any soil from one treatment to another. All equipment was washed thoroughly and disinfested.

Treatments were as follows:

Calcium Cyanamide: AERO Cyanamid Granular was spread evenly over a flat plot at a rate of 1,000 lbs./acre, raked in lightly by hand and irrigated into the soil after first building a ridge of soil around each plot.

Chloropicrin: Dow's Picfume was injected at a rate of 34.5 gal./acre.

D-D (1,3-dichloropropene and 1,2-dichloropropane): Shell's D-D was applied at two rates, 20 and 60 gal./acre.

PCNB (pentachloronitrobenzene): Mathieson's Terrachlor, 75% wettable powder, was spread evenly over a flat plot at a rate of 200 lbs./acre to provide 150 lbs. of active material. It was thoroughly mixed with the soil to a depth of 7 inches by a Howard Rotovator.

Vapam (sodium-N-methyl dithiocarbamate): Stauffer's 31% liquid was injected at a rate of 60 gal./acre in 60 gal. of water.

Control: Control plots remained untreated; they were not chiseled.

In order to match the amount of nitrogen in the cyanamide plots, 1,000 lbs./acre of ammonium sulfate was added to the remaining plots. They were not flooded afterward because of the difficulty of constructing 28 separate borders and because much of the fertilizer would be leached out. This heavy application, however, created a salt problem in the beds which caused uneven and late emergence. Many of the injured plants died of a root rot.

Lettuce variety Great Lakes No. 66 was planted December 6 and began to emerge December 15. Only the cyanamide plots showed vigorous growth of good stands, probably because these plots seemed to have no salt problem.

The two center beds in each plot were used for recording results on March 10 and 26. A record was made of the total number of plants and the number showing big-vein symptoms; from these the percentage big vein was calculated. These figures were compared by analysis of variance, covariance, and Duncan's multiple-range test.

Soil temperatures were recorded by a Taylor 7-day recording thermometer. The bulb was buried 6 inches deep in the seed-row of a plot. The instrument was held in a weather-station-type raised, ventilated box. Air temperatures were recorded by a Friez recorder which was placed in a box on the soil. The box was resting on its side to shade the instrument and was painted with aluminum paint to reflect heat.

RESULTS

Big Vein: None of the treatments resulted in less big vein than the control. PCNB and Vapam were not significantly different from the control. Chloropicrin, D-D and calcium cyanamide plots had significantly more big vein during the March 26 reading and calcium cyanamide and D-D 60 plots showed significantly more at the March 10 reading.

Stand: Because of the salt problem created by the heavy fertilizer applications, only the leached calcium cyanamide plots had good stands and vigorous growth. The root rot which attended salt injury was apparently controlled better by D-D than by other treatments. At the first (3-10-59) reading D-D 20 plots had significantly better stands than controls when cyanamide was included in the analysis. Both D-D treatments resulted in better stand counts than Vapam, chloropicrin, PCNB and controls (but not significantly better).

Soil and Air Temperatures: Soil temperature weekly means increased from 48.5° F in early February to 64.6° F in early April. Similarly, the weekly minima rose from 40° to 54° and maxima from 56° to 75° F. The daily minima usually occurred at 10:00 a.m. in early February and gradually appeared earlier until April's 8:00 a.m. minima. Maximum soil temperatures occurred at 6:00 p.m. in February and usually at 5:00 p.m. in April.

Air temperature weekly means increased from 57.9° F in early January to 73.2° F in April. The weekly minima rose from 39° to 48° and maxima from 82° to 103° F. In January the daily minima usually were reached at 7:00 a.m. but at 4:00 a.m. in April. Maximum air temperatures occurred mostly at 2:00 p.m. in both January and April.

Soil temperature extremes lagged considerably behind air temperature extremes. In February, the 7:00 a.m. daily air minimum was followed by a soil minimum at 10:00 a.m.; in April it occurred in air at 4:00 a.m. and in soil at 8:00 a.m. The daily maximum air temperature was reached in February at 3:00 p.m. but in soil not until 6:00 p.m. In April, air maximum temperature appeared at 2:00 p.m. and soil maximum at 5:00 p.m.

Air temperature maxima recorded at the Mesa Farm's weather station (5 ft. above ground) varied considerably from the maxima recorded near the soil surface in the big vein plots. The minima showed little variation. Maximum temperatures near the soil averaged 8.7 degrees higher than those reported at the Station.

CONCLUSIONS

The fact that big vein was found in all treatments might be explained in at least 2 ways. Either the fungicides did not satisfactorily control the fungus or the plots were quickly contaminated. Differences in amounts of big vein were most likely due to differences in plant vigor. Even though plants in the calcium cyanamide plots had the most big vein, they were by far the healthiest. These plants matured earlier, when temperatures were more conducive to symptom expression and infection. Treatments resulting in less big vein contained lettuce that grew slowly and matured while temperatures were too high for optimum infection and symptom expression. The experiment is being repeated.

ZINC CONTENT OF PLANTS WITH BIG VEIN

by R. B. Marlatt, Plant Pathology Department
and
by G. C. Sharples, Horticulture Department

Normal appearing lettuce plants and plants showing big-vein symptoms were collected from a field in Deer Valley, February 13, 1957.

In the laboratory, roots were removed, leaves from cap-leaf to heart were then torn from the stem and rinsed individually to remove large soil particles. Leaves from 3 plants were shaken in water containing detergent. All of the leaves were then rinsed twice in distilled water. Several batches of 3 plants each were prepared.

Leaves were dried in a forced-air oven at 75° C. overnight. They were then ground in a Wiley mill.

April 11, 1958, 10 additional healthy and 10 big vein plants were collected from a field near Mesa. Leaves were cleaned and dried as described above. Leaves from each head were kept as separate samples and analyzed for zinc.

RESULTS

There was very little difference in zinc contents of healthy vs. big vein diseased lettuce. (See Table 10.)

Table 10. Zinc content of healthy (H) and big vein (BV) lettuce.

No.		Wt.	Read	Mgm.	PPM Healthy	PPM Big Vein
1	H 1	1.0191	0.57	9.3	9.1	
2	BV 1	1.0147	0.60	10.0		9.9
3	H 2	1.0163	0.82	13.5	13.3	
4	BV 2	1.0160	0.68	11.1		10.9
5	H 3	1.0311	0.70	11.6	11.3	
6	BV 3	1.0296	0.92	15.0		14.6
7	H 4	1.0352	0.49	8.0	7.7	
8	BV 4	1.0341	0.47	7.8		7.5
9	H 5	1.0380	0.46	7.7	7.4	
10	BV 5	1.0201	0.45	7.5		7.4
11	H 6	1.0132	0.57	9.3	9.2	
12	BV 6	1.0038	0.70	11.6		11.5
13	H 7	2.008	1.97	32.3	16.1	
14	BV 7	2.032	1.20	19.8		9.8
15	H 8	2.033	1.31	21.6	10.6	
16	BV 8	2.014	1.42	23.3		11.5

Table 10. (Continued)

No.		Wt.	Read	Mgm.	PPM Healthy	PPM Big Vein
17	H 9	2.026	1.26	20.7	10.2	
18	BV 9	2.012	1.64	27.0		13.4
19	H 10	2.020	1.23	20.1	10.0	
20	BV 10	2.032	1.16	18.9		9.3
21	H 144	2.005	1.63	26.8	13.4	
22	BV 145	2.023	1.46	23.9		11.8
23	H 146	2.033	1.57	25.7	12.6	
24	BV 147	2.041	2.06	33.7		16.5
					10.9	11.2 - Averages

Method: Jackson, R. K. and J. G. Brown. 1956. The determination of zinc in plant material without the use of organic extracts. Am. Soc. Hort. Sci. Proc. 68:1-5.

BIG VEIN IN LETTUCE; CROP ROTATION AND IRRIGATION TREATMENTS

by R. B. Marlatt, Plant Pathology Department
and
by W. D. Pew, Horticulture Department

I. Lettuce plants showing big vein symptoms were collected in a field east of Aguila, Arizona, May 27, 1959. It was said to be the first crop in the soil. Healthy-appearing plants were also collected. All plants had formed heads but were not quite of marketable size.

Pieces of root epidermis 1 or 2 mm in diameter were examined microscopically for Olpidium (the fungus that causes big vein). From each plant four from the tap-root and four from four laterals were observed; Olpidium was recorded as present or absent.

Forty-eight pieces of epidermis from 6 big vein affected plants were examined and 26 pieces contained an Olpidium. Only 2 of the 48 pieces from 6 healthy plants contained Olpidium.

II. Effects of Crop Rotation:

The amounts of big vein were recorded in a crop-rotation experiment (Field A, borders 5 through 17) on the Mesa Farm. Each plot consisted of 5 beds and 2 half-beds. Table 11 shows the types of rotations used. The number of plants and the number showing big vein were counted March 10 and 30 in the center bed of each plot. All observations were made while facing south between 10 a.m. and noon, so that the amount and direction of light falling on the plants was about the same for all plots.

The percentage big vein was calculated for each plot and percentages were changed to arcsins because they ranged lower than 30%. The arcsins for each reading were compared by analysis of variance.

As shown by Table 12, the manured plots contained significantly more lettuce showing big vein symptoms than the other rotations. This may have been due to the faster growth of manured plants and, hence, their greater development under temperatures more favorable for infection and symptom expression.

None of the crop rotations resulted in less big vein than the controls of alternate lettuce and melons.

III. Irrigation Treatments:

The amount of big vein was recorded in a lettuce irrigation experiment (Field A, borders 24, 25 and 26) on the Mesa Farm.

Three irrigation treatments consisted of: Dry-maximum irrometer reading of 75 to 80, Medium -- irrometer 35 to 40, Wet -- 18 to 20. Big vein readings were made while facing south at 10 a.m. to 12 noon, to have about the same light when reading the plots. Plants in the 2 center beds of each plot were counted and the number showing big vein recorded. These figures were used to calculate percentages having big vein and arcsins of these percentages were compared by analysis of variance.

Table 13 shows there were no significant differences in amounts of big vein despite the great differences in irrigation.

Table 11. Crop rotation before making big vein readings.

Season	Type of Rotation				
	Papago Peas	Manure	Alfalfa	Guar	Control
Winter, 1958-59	Lettuce	Manure & Lettuce	Lettuce	Fallow	Lettuce
Summer, 1958	Melons	Melons	Melons	Guar	Melons
Winter, 1957-58	Peas	Lettuce	Alfalfa	Lettuce	Lettuce
Summer, 1957	Melons	Melons	Alfalfa	Melons	Melons
Winter, 1956-57	Lettuce	Manure & Lettuce	Alfalfa	Lettuce	Lettuce
Summer, 1956	Melons	Melons	Melons	Guar	Melons
Winter, 1955-56	Peas	Lettuce	Lettuce	Lettuce	Lettuce

Table 12. Effects of crop rotation on big-vein incidence.

Treatment	Amount of Big Vein Arcsins, Averages of 4 reps.	
	March 10 Reading	March 30 Reading
Peas	8.65[a]	26.75[a]
Control	10.83[a]	30.15[a]
Alfalfa	11.25[a]	25.00[a]
Manure	20.30	38.43

[a]Figures not significantly different from one another, Duncan's Multiple Range Test, 5% level.

Table 13. Effects of three levels of irrigation on big vein incidence.

Treatment	Amounts of big vein Arcsins, averages of 6 replications
Dry	24.17[a]
Medium	25.33
Wet	24.33

[a]Averages were not significantly different.

LETTUCE INSECT CONTROL STUDIES

by Paul D. Gerhardt
Department of Entomology

During 1959 two phases of the insect control problem on lettuce were studied. One phase, to which considerable time and effort has been devoted, is the problem of insecticide residue that may occur on lettuce at harvest. Some of the important points that have been considered in these studies are (1) rates of application, (2) number of applications, (3) interval between last insecticide application and harvest, (4) effects of temperature, and (5) methods of sampling lettuce for insecticide residue studies. Certain of the older as well as some newer insecticides have been studied in connection with this residue problem. Insecticides considered to date are Endrin, Toxaphene, DDT, Parathion, Dylox and Sevin.

Residue analyses have been conducted in part by the Department of Entomology, Insect Toxicology Section, under the direction of Dr. J. M. Witt. Other residue analyses have been carried out by various insecticide company laboratories. As the laboratory analysis of some of these samples are not complete at this date, the detailed information will be released at a later date.

The other phase of lettuce insect control considered, dealt with the use of several newer insecticides for the control of some of the insects listed below.

This past season there were moderate to heavy populations of the following lepidopterous pests. Not all were present in every lettuce field.

1. Cabbage looper - Tricoplusia ni (Hbn).
2. Beet armyworm - Laphygma exigua (Hbn).
3. Yellow-striped armyworm - Prodenia ornithogalli Guen.
4. Fall armyworm - Laphygma ferugiperda (J. E. Smith).
5. Bollworm or corn earworm - Heliothis zea (Boddie).
6. Salt-Marsh caterpillar - Estigmene acrea (Drury).

These insects were most numerous in the fall lettuce, although they also occur, to a lesser degree, in the other plantings.

Three new numbered compounds from Chemagro Corporation were applied as dusts to replicated plots of lettuce. Of these three, Bayer 22408 and Bayer 28589 looked promising for control of loopers, beet armyworm and yellow-striped armyworm.

Another material that was evaluated was American Cyanamid's compound 24055 which is referred to as an "antifeeding compound." Spray applications of wettable powder to lettuce indicated a reduction in the amount of feeding by pests listed previously. Further field studies with this material are planned.

Limited trials with two Shell compounds, applied as sprays at two dosage levels, indicate that SD-5539 at 1 pound per acre gave good control.

In all cases, thorough application of material for control of lepidoptera larvae is important. Likewise, control of the larvae before they reach the 4th and 5th instar is important.

Another material of interest, in that it may be used close to harvest without leaving harmful residues, is the Bacillus thuringiensis B. Applications of bacillus dust, containing 5 billion spores per gram, at 30 pounds per acre gave satisfactory control of the beet armyworms and loopers in a replicated test.

None of these materials are recommended for use at this time.

LETTUCE INSECT STUDIES

by Ross W. Brubaker, Entomology Research Division, Agricultural Research Service, U. S. Department of Agriculture

Experiments conducted on spring crop lettuce are aimed at aphid control, primarily, while those on the fall crop are concerned more with control of the cabbage looper, the beet armyworm, and other caterpillars.

Large-plot (approx. 1 acre each) unreplicated tests on spring lettuce near Tolleson indicated that sprays of phorate and dimethoate were equal to a parathion spray of equivalent active ingredient per acre in reducing the number of aphids found on the sampling areas 2 days after treating. Population counts made 7 and 16 days after treating indicated that parathion lost its effectiveness sooner than the other two, this being quite evident in the 16-day account. All the materials were effective compared to an untreated area.

Three granular materials and 3 sprays were tried out against aphids in another unreplicated field test on spring lettuce near Peoria. The granular insecticides were applied by means of a Planet Jr. seeder. They were drilled under the surface of the soil, alongside each row of lettuce, as in side-dressing with fertilizer. The sprays were applied by a tractor mounted trailing boom sprayer with 3 nozzles per lettuce row. Applications were made on April 10, and the field irrigated April 11 so the granular materials soon got into solution. Population counts were made on 20 plants at random on each plot on April 14, 21, and 29, and the data so obtained are shown in the following table.

Treatments	Active ingred. lbs./A	Number wingless aphids found per 20-plant samples after 4 days	11 days	19 days[a]
Phorate, 5% granular	2.88	460	760	34
Dimethoate, 5% granular	2.88	200	60	1
Di-Syston, 5% granular	2.88	320	740	7
Thiodan spray	.5	180	1060	9
Dimethoate spray	.5	100	240	4
Parathion spray	.5	160	1220	9
Untreated (by us) check	---	600	1240	5

a/ Small numbers this date because entire field had been treated with Phosdrin a day or so before.

A randomized block field experiment was conducted on fall crop lettuce near Tolleson, in which 4 replicates were made of 5 dusts, 5 sprays, and 1 as a granular material side-dressed in the soil along the lettuce rows. The plots were 100 feet long and 8 lettuce rows wide. The dusts and sprays were applied by a tractor-mounted trailing boom combination sprayer-duster, with the tractor speed held at 3 miles per hour. The effectiveness of the various treatments was determined by counting the numbers of cabbage looper larvae surviving 5 days after the first application, and 8 days after the second application.

In this experiment the recommended treatments toxaphene plus DDT, or parathion plus toxaphene plus DDT, gave good results either as dusts or as sprays. Endrin as a spray gave better control of the looper than as a dust at the same dosage. Korlan spray did not give good results although it was better than no treatment. Dylox spray was among the most effective treatments. A 7-1/2 percent Sevin dust was inferior to the best treatments in the first application but showed up a little better in the second. *Bacillus thuringiensis* dust in the first application with a calculated strength of 1 billion spores per gram and applied at the rate of 26 pounds per acre, gave inferior control of loopers in comparison with the best insecticides although it was partially effective. In the second application a *B. thuringiensis* dust that contained 5 billion spores per gram was used and it was as effective against the loopers as the best insecticides.

In small plot experiments American Cyanamid 24055 antifeeding compound was compared with *B. thuringiensis*. Plots were prepared by enclosing lettuce plants with an aluminum foil barrier and placing a definite number of large caterpillars in each plot. Some difficulties occurred in keeping the more active species, such as salt-marsh caterpillars, from escaping and the barriers were sometimes torn down by tractor tires during cultivation, but some very interesting information was obtained. The antifeeding compound, a 25 percent wettable powder, was applied by a knapsack sprayer at 2 pounds of active ingredient in 50 gallons of spray per acre. A *B. thuringiensis* dust containing 5 billion spores per gram was applied with a rotary hand duster at about 25 pounds per acre. It was observed that both treatments kept salt-marsh caterpillars and cabbage loopers from feeding on the treated plants, even though they crawled all over the plants and around the enclosed plots until they died. There was some mortality due to both treatments since more died than in the checks, but whether it was due to toxicity or starvation is not known. The remarkable thing was that the lettuce plants were protected for 7 or 8 days, during which time some of the plants in the check plots were eaten to the ground. In similar tests the antifeeding compound also kept beet armyworms from feeding on lettuce. Freshly collected salt-marsh caterpillars placed on lettuce that had been treated with the antifeeding compound or with *B. thuringinesis* eight days earlier were not inhibited from feeding in a normal manner and no obvious evidence of toxic residue was evident. Both materials show such promise against the lepidopterous pests of fall lettuce that further tests are planned.

LETTUCE BREEDING AND GAMETOCIDE STUDIES

by R. E. Foster and E. L. Murdock
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The lettuce breeding program was reduced in scope during the past season in order to devote more time and funds to the extensive variety test program.

Plantings were made on The University of Arizona Mesa and Yuma Experiment Stations. Roguing and leaf-by-leaf head selections were made continuing the programs for improving tipburn resistant lines (especially Imperial types - a Great Lakes type is ready for release) and for intensifying rib discoloration resistance.

Seed was increased of the new variety and of several other promising stocks.

Preliminary studies were begun on big vein and on the possibility of developing resistance to this soil-borne disease. A big vein breeding plot was established on the Yuma Experiment Station and attempts were made to increase the level of infestation there.

Work will be continued and increased on breeding for resistance to tipburn, rib discoloration, and big vein.

Resistance to downy mildew disease in lettuce is on hand in many hybrid progeny in the breeding program. This phase of activity was designed to develop a Great Lakes type of lettuce carrying immunity to downy mildew. Many of the important Great Lakes strains (including the new U of A tipburn resistant stock) have been used in the program to increase the possibility of developing a superior variety.

(Note: the new variety, "Valverde" has been received with favor in many mildew areas. This is not widely suited to the Arizona industry because it is an Imperial type.)

Lettuce Gametocide Studies. Normally, lettuce is almost entirely a self-pollinated crop. If first generation hybrid seed could be produced on a commercial basis, advantages involving size, uniformity, disease resistance, and maintenance of strain purity and identity would be possible.

Experiments have been conducted in the Mesa Experiment Station greenhouse using a new material reported to render some plants male-sterile. This experimental material (Rohm & Haas FW 450, sodium 2,3 - dichloroisobutyrate) was originally developed as an herbicide. In greenhouse tests several concentrations were tried. In each case that pollen sterility was induced, the plants were severely affected by the herbicidal property of the compound. The damage resembled somewhat an iron deficiency or nitrogen deficiency.

Subsequently, lettuce plants in 12" pots were grown to the beginning of seedstalk formation. These were then sprayed with various concentrations of the gametocide. In addition some spray treatments contained urea and a chelated iron compound. No reduction in herbicidal effect was noted from the additives.

Field-grown lettuce plants were used in the latest test. Plants were sprayed in replicated treatments with concentrations of F. W. 450 of 300 ppm, 600 ppm, 1200 ppm, 2400 ppm, and 4800 ppm. Applications of each concentration were made one to four times by spraying appropriate plots at weekly intervals starting at the time of seed-stalk formation.

Herbicidal injury was noted from the high concentrations applied three or four times. Common symptoms involved leaf burning and killing. The 4800 ppm solution sprayed four times caused stunting of all plants and death to some.

Non-development of anthers and lack of pollen was noted from the following treatments: 2400 ppm 4 times, 4800 ppm 3 times, and 4800 ppm 4 times. Flowers were somewhat smaller and petals were slightly distorted. Styles were often shorter than normal and were frequently bent. Male sterile flowers receiving foreign pollen developed viable seed.

The male sterile effect first appeared 10 - 16 days after the last spray and in all cases lasted from 12 to 18 days. At the end of the effective period both male sterile and male fertile flowers appeared for several days and from then on all flowers appeared normal.

Apparently it is necessary for the concentration of the gametocide to reach a certain minimum concentration in plant tissue before the sterility effect is evident. This can be accomplished by applying the material in high concentration or by making frequent applications in lower concentration. Behavior of the lettuce plants in the field test indicates that either (1) the gametocide is slowly destroyed in the plant, or (2) it is dissipated, or (3) it is diluted by new tissue growth, or (4) the plant becomes more tolerant to gametocidal effects.

Maintenance of the minimum concentration of FW 450 in the lettuce plant would be necessary to obtain continued effects and to produce pure hybrid seed. This may best be accomplished by frequent application of lower concentration sprays. This method and others will be tested during the coming season.

LETTUCE VARIETY TRIALS IN ARIZONA

by R. E. Foster, P. M. Bessey and E. L. Murdock
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Information on the performance of lettuce strains became urgently needed with the rapid expansion of the lettuce industry near Willcox, Arizona. In cooperation with Mr. Carmy Page, Cochise County Agent in Charge, Mr. Harvey Tate, Extension Horticulturist, and with prominent lettuce growers of the area, the authors began strain testing in some of the first large lettuce plantings and continued the program through two years. Trials were also made in the Aguila (cooperating with Bob Grounds, Assistant Co. Agent) and Yuma (cooperating with Lowell True, Assistant Co. Agent) districts where additional variety information was desired.

Seeds of all the popular Great Lakes strains were assembled along with one Imperial representative for comparison. As new strains became available they were added to the tests. Table 14 lists the strains used, the source of seed and other identification. There was no discrimination as to source except that in some cases strains were obtained where available. No attempt was made to compare the same strains from different sources although it is recognized that differences between such lines might be greater than variations among strains of different designations.

All of the seed used was donated by the sources listed in Table 14. For this The University of Arizona and the staff concerned are truly grateful. A special expression of gratitude should be made to the Jerome Kantro Co., Pete Pasquinelli Co., Sulfur Springs Valley Farms (3 tests), Willcox Lettuce Growers, Cochise Lettuce Growers (3 tests), Engebretson-Grupe Co., McLaren Co., Bruce Church Co., The Garin Co., Martori Brothers, and The Norton Co., on whose ranches the tests were placed, for the donation of land, labor, time, and care given each trial.

The University, the authors and the cooperators appreciate very much the intense interest shown in the trials by growers, seedsmen, students, and the general public. Comments and suggestions received at special field meetings were very helpful.

In all tests, strains were planted at random in each of four replications. Planting was done with each grower's equipment and all cultural operations were performed by the grower up to harvest time. At maturity, certain field data were taken by variety - replication. Mature heads were then cut, packed in standard cartons, vacuum-cooled when necessary, and hauled to Mesa. At the Mesa Experiment Station the lettuce was held in temperature-controlled rooms to simulate commercial shipping and storage conditions. Following this, cartons were opened and each head scored for important characteristics. Data were taken on the basis of complicated measuring, weighing, and rating systems. The vast number of figures obtained were processed by modern electronic computing machines in the U. of A. Data Reduction Center. The authors are indebted to Dr. Henry Tucker, Statistician, for all of his assistance in handling the data.

In most cases resulting numbers have been interpreted in adjective form to facilitate understanding and comparison. This information is presented for each trial in the following tables. Trial IV did not reach maturity. Please refer to the footnote page for explanations.

(Trials I thru XV)

The varieties are ranked for each test on the basis of "percent marketable heads over an approximate 10-day harvest period". This category was judged to be of primary importance, not only to indicate the heading ability and relative uniformity of the strains but also to indicate the yield that might be expected under average harvesting conditions. It should be realized that strains did not have the same maturity date. At the time data were taken early strains were near the end of their 10-day periods while for the later strains the commercial harvest program would have just begun. No strain was either so early or so late in average maturity as to affect its use although non-uniformity in maturing is reflected in the percent marketable figure.

It is significant to note that three of the oldest strains, G. L. Premier, Emerald, and GL 428 were consistently within the highest yielding groups. Some of the more recent developments were high in the "percent marketable" column in only a few of the tests (see Table 15). There has been considerable emphasis on selecting new strains for adaptability to certain seasons and even certain areas. The necessity or desirability of this practice seems to be challenged by the above data.

Definite seasonal adaptability was seen definitely in regard to some of the strains. GL 659 did well in all three of the fall-maturing tests but not in the spring tests. This selection has been described correctly as a fall type. Other types performed better in the spring harvests than they did in the fall (for example: GL 366 and Golden State A). Of greater interest is the fact that GL 428 often described as a "spring lettuce" also did very well in the fall tests. Several strains performed satisfactorily in both seasons indicating that other factors might be more important than seasonal adaptation (perhaps more correctly termed "seasonal restriction").

Physical characteristics noted in the field (columns 3,4,5,6, & 7) were difficult to measure accurately. Also these varied from test to test depending probably on season and on individual cultural methods. For the most part these characteristics were acceptable for all varieties with but a few exceptions. Certain G. L. strains seemed to have a greater tendency to bolt. Premier, Emerald, GL 59 & GL 428 were often of light green to yellowish color. The 659's (especially out of season) and Premier showed a less desirable wrap characteristic.

There were not serious or consistent differences between strains in regard to butt shape or rib prominence. The same was true for core diameter except that new types, Vanguard, Merit, and Climax tended to produce broad cores.

In Trials V, VI, VII, and XII core length was an important factor influencing lettuce quality. External evidence of bolting was noted in these three earlier tests but not in Trial XII. Strangely enough the figures do not indicate a strong correlation between long core length and a tendency to bolting. This apparent paradox can be attributed to the variability between plants in any one strain.

The desirable short-core characteristic of the Golden State strains, of Merit, and of the 659's is demonstrated in Test XII.

There are only a few valid generalities to note in regard to internal lettuce head blemishes. Pink rib was of sporadic importance in all tests except those harvested in the fall. Varieties did not differ much in apparent susceptibility to the trouble. When statistical analysis of the average ratings (7 tests) is made, there is an indication of a "low pink rib" group (Golden State C, Merit, 66, 65, TBRC, GSD, Wes Pak, 366A, Regular, A36, 66, 118) and a "high pink rib" group containing the strains Premier, 54, 659, 407, 428, 366, Gem, TBRD, Shippers, 59, 407P, Grandeverde, and R200-95. In no test was pink rib development severe enough to reduce marketable yield appreciably.

Rib discoloration was of minor importance throughout the testing program. In some tests only a minimum amount of the disease was seen (all strains rated "excellent"). Statistical comparison of variety averages for seven of the trials revealed some apparent difference in varietal susceptibility to the trouble. Strains GSB, GSD, Merit, GSC, 366, R200, Oroverde, Gem, Regular, 659, and TBRD all were low in rib discoloration. Most severe development of the disease could be found in Premier, 13, 66, 118, 660, 65, and A36.

The average tipburn level varied considerably from test to test. There was little or no trouble in the fall trials. In the spring tests tipburn tended to increase in each locality as the season progressed. Varieties differed considerably in reaction to tipburn. Statistically. 659G, TBRC, 659, 366A, 65, 66, Regular, 660, R200-95, 407P, Shippers, Grandeverde, R200, Premier, and A36 showed less disease. GSC, 54, GSB and GSA developed the most tipburn.

Russet spotting was present in sufficient amounts to measure only in the 1959 trials. It was not of much concern except in Test VIII, spring harvest - Yuma. By comparing average ratings from seven trials, apparent variety differences in development of the disease showed up with, for example, strains 65, Regular, Wes Pak, 66, 407P, 660, and R200-95 developing significantly less russet spotting than strains 59, Merit, Shippers, or GSC.

It is difficult to recommend individual strains for certain periods or certain areas. Each variety seems to have both good and bad features and so choice of planting stock depends somewhat upon local requirements and local history. If, for example, a field tended to produce non-uniform lettuce or heads of small size, then it would be well to choose from the group of "sure-heading" strains and use one that has a tendency to produce a large frame and heavy heads.

If pink rib has been a particular problem during a season or in some location, the grower should choose a strain which is less susceptible to the disease but which still meets other requirements.

The tables were arranged according to "yielding" ability of the varieties. If that were the only item considered, Premier or GL 59 would be obvious choices for most plantings. However, color, wrap, pink rib, and rib discoloration ratings are poor for Premier and GL 59 is not always desirable in these and other categories.

It is for the above reason that strains are listed in groups. On a statistical basis it cannot be said that any strain in the top group of each table differs from any other in that group in the "percent marketable" category. So any of the "top strains" can be expected to give a good cut-out. Selection, then, can be made by individual growers from within the top groups depending upon the degree to which strains meet other important requirements. Satisfactory estimates of this can be obtained in the other columns in each table.

Table 14

LETTUCE STRAINS IN TRIAL

Strain		Source	Lot. No.
Great Lakes	118	Asgrow	77097
Great Lakes	59	Asgrow	77091
Great Lakes	65	Asgrow	37215
Great Lakes	66	Asgrow	77093
Great Lakes	428	Asgrow	77378
Great Lakes	Regular	Ferry Morse	22893
Great Lakes	54	Ferry Morse	25935
Great Lakes	366	Ferry Morse	25933
Great Lakes	407 P	Ferry Morse	25903
	Wes Pak	Ferry Morse	25813
	Wes Green	Ferry Morse	25900
Great Lakes	R200	Pieters Wheeler	-
Great Lakes	Premier	Pieters Wheeler	-
Great Lakes	659	Pieters Wheeler	-
Great Lakes	407	Dessert	3527-15
Great Lakes	659G	Dessert	3786-24
Great Lakes	366A	Dessert	321B6-7
Great Lakes	660	Dessert	3236-9
Great Lakes	A 36	Dessert	32107-15
	Emerald	Dessert	3517-11
	Gem	Dessert	3527-19R
Great Lakes	R200-95	Rohnert	S/N 633702
Great Lakes	Shippers Strain 212	Rohnert	S/N 734102
	Grandeverde	Rohnert	336707
	Oroverde	Rohnert	S/N 733304
Imperial	749	Rohnert	S/N 439702
Great Lakes	13	Asgrow	P C 56206
Golden State	A	Dr. Ross Thompson & Dr. Ed. Ryder, USDA	6064
Golden State	B	Dr. Ross Thompson & Dr. Ed. Ryder, USDA	6065
Golden State	C	Dr. Ross Thompson & Dr. Ed Ryder, USDA	6068
Golden State	D	Dr. Ross Thompson & Dr. Ed Ryder, USDA	6067
Climax		Dr. Ross Thompson & Dr. Ed Ryder, USDA	6703
Vanguard		Dr. Ross Thompson & Dr. Ed Ryder, USDA	6701
Merit		Pieters Wheeler	2747
TBR C		Foster	
TBR D		Foster	
	Primaverde	Germain's	059-61-801
Great Lakes	Phoenix	Germain's	059-34-801

Table 15

Strain	No. of times tried in Spring trials	In top mkt group - Spring: No. of times	In top mkt group - Spring: Per-cent	No. of times tried in Fall trials	In top mkt group - Fall: No. of times	In top mkt group - Fall: Per-cent
GL 118	11	4	36	3	2	67
GL 59	11	10	91	3	2	67
GL 65	11	2	18	3	1	33
GL 66	11	2	18	3	1	33
GL 428	11	9	82	3	2	67
GL Regular	11	0	0	3	0	0
GL 54	11	2	18	3	0	0
GL 366	11	7	64	3	0	0
GL 407P	11	5	45	3	1	33
Wes Pak	11	2	18	3	0	0
Wes Green	11	0	0	3	0	0
GL R200	11	2	18	3	0	0
GL Premier	11	10	91	3	3	100
GL 659	11	0	0	3	3	100
GL 407	11	3	27	3	0	0
GL 659G	11	0	0	3	2	67
GL 366A	11	1	9	3	0	0
GL 660	11	9	82	3	1	33
GL A36	11	2	18	3	2	67
Emerald	11	9	82	3	2	67
Gem	11	3	27	3	0	0
GL R200-95	11	2	18	3	1	33
GL Shippers	11	2	18	3	0	0
Grandeverde	11	4	36	3	0	0
Oroverde	11	2	18	3	0	0
Imperial 749	11	2	18	3	0	0
GL 13	10	5	50	3	1	33
Golden State A	8	0	0	2	2	100
Golden State B	8	3	38	2	1	50
Golden State C	8	2	25	1	1	100
Golden State D	8	5	63	0	-	-
Climax	7	4	57	0	-	-
Vanguard	6	4	67	0	-	-
Merit	8	5	63	0	-	-
TBR C	8	6	75	0	-	-
TBR D	8	7	88	0	-	-
Primaverde	3	0	0	0	-	-
GL Phoenix	3	0	0	0	-	-

Table 15 - Summary of lettuce strain performance by season.

Lettuce Strains in Trial I Grown Near Willcox 18 February to 28 May, 1958.

1 Strain	2 % Mkt.	3 % Bolt	4 Green Color	5 Frame Size	6 Head Shape	7 Wrap or Cover	8 Butt Shape	9 Rib Prom.	10 Core Diam.	11 Core Length	12 Pink Rib	13 Rib Disc.	14 Tip- Burn	15 Russet Spot	16 Wt. 24 Heads
GL 428	49.3	0	M	ML	F	GA					GA	G	EG		35.8
GL Premier	47.5	0	Y	ML	F	A					A	G	G		41.1
GL 407P	45.9	0	M	M	F	G					EG	EG	EG		36.0
Emerald	45.9	0	YM	ML	R	A					EG	EG	EG		38.5
Shippers	44.6	0	M	M	R	GA					EG	E	EG		34.2
GL 660	43.5	0	M	M	R	G					G	EG	E		38.0
GL 366	42.6	0	MD	M	R	G					EG	E	EG		33.1
Grandeverde	40.5	0	M	M	R	G					EG	EG	EG		37.0
GL R2CO	38.2	0	MD	M	R	GA					G	EG	G		41.5
GL 59	36.9	0	M	MS	R	AP					EG	EG	EG		34.0
Gem	36.6	0	YM	ML	R	GA					EG	EG	EG		31.4
Imp 749	33.6	0	Y	ML	R	A					G	EG	G		38.8
GL 54	31.1	0	D	M	F	A					G	EG	GA		35.1
Wes Pak	31.0	0	M	L	F	GA					E	E	EG		32.8
GL R200-95	29.0	0	M	M	RF	GA					E	EG	EG		29.9
GL 407	27.6	0	M	M	R	A					EG	E	E		36.8
Oroverde	26.1	0	M	M	R	GA					EG	EG	EG		36.0
GL 366A	26.0	0	M	M	R	GA					G	EG	EG		38.0
GL 659	23.2	0	Y	M	R	A					EG	EG	EG		39.4
GL A36	22.0	0	M	M	R	A					EG	E	G		36.4
GL 65	21.9	0	MD	SM	RF	AP					E	EG	EG		26.5
GL 66	21.1	0	M	M	R	AP					EG	EG	EG		33.7
GL Regular	20.4	0	M	SM	R	A					E	E	G		36.9
GL 118	14.3	0	YM	M	R	A					EG	EG	EG		30.4
Wes Green	10.0	0	M	L	-	P					E	E	GA		30.5
GL 659G	9.2	0	YM	SM	R	A					EG	E	E		27.7

see footnotes

Lettuce Strains in Trial II Grown Near Willcox 2 April to 13 June, 1958.

1 Strain	2 % Mkt.	3 % Bolt	4 Green Color	5 Frame Size	6 Head Shape	7 Wrap or Cover	8 Butt Shape	9 Rib Prom.	10 Core Diam.	11 Core Length	12 Pink Rib	13 Rib Disc.	14 Tip- Burn	15 Russet Spot	16 Wt. 24 Heads
Grandeverde	91.4	0	M	L		GA					G	EG	GA		38.2
GL 366A	90.7	0	M	L		A					EG	EG	G		38.6
GL 660	90.5	0	M	L		A					E	EG	GA		38.2
GL 59	88.8	0	YM	L		AP					EG	EG	G		44.8
GL 13	88.7	0	YM	L		G					GA	EG	GA		46.8
Oroverde	88.2	0	M	L		AP					GA	E	A		44.0
GL R200	88.0	0	M	L		G					G	EG	GA		43.6
GL 428	87.7	0	YM	L		A					EG	EG	EG		41.0
GL 118	87.1	0	M	L		GA					EG	EG	G		35.6
GL 66	86.9	0	M	L		G					EG	EG	G		37.2
Wes Pak	86.8	0	MD	L		GA					EG	EG	G		36.8
GL 65	84.2	0	M	L		A					EG	EG	G		37.8
Emerald	83.2	0	YM	L		GA					EG	EG	GA		44.0
GL R200-95	83.0	0	M	L		AP					EG	EG	G		43.2
GL Ship Str	83.0	0	M	L		A					EG	E	GA		39.0
GL A36	82.8	0	M	ML		A					EG	E	G		43.8
GL 407	82.4	0	M	L		A					E	EG	G		41.6
GL 407P	82.1	0	M	L		GA					EG	E	G		37.6
GL Premier	81.8	0	Y	L		A					EG	EG	A		40.0
GL 366	81.4	0	M	L		A					G	E	G		39.8
GL 659G	79.0	0	YM	M		A					EG	EG	GA		40.6
GL Regular	77.1	0	M	L		A					EG	EG	GA		43.0
Gem	76.8	0	M	L		AP					G	G	GA		38.0
GL 54	75.9	0	MD	L		GA					E	E	GA		41.0
GL 659	70.8	0	YM	M		A					EG	EG	EG		37.0
Wes Green	0	0	D	L		-					-	-	-		-
Imp 749	0	0	D	L		-					E	E	-		-

See footnotes.

Lettuce Strains in Trial III Grown Near Willcox 1 April to 18 June, 1958.

1 Strain	2 % Mkt.	3 % Bolt	4 Green Color	5 Frame Size	6 Head Shape	7 Wrap or Cover	8 Butt Shape	9 Rib Prom.	10 Core Diam.	11 Core Length	12 Pink Rib	13 Rib Disc.	14 Tip-Burn	15 Russet Spot	16 Wt. 24 Heads
GL Premier	55.6	0	Y	M	R	AP	R				E	EG	GA		34.3
GL 13	51.6	0	M	M	RF	AP	RF				G	EG	G		32.5
GL 428	47.8	0	M	M	F	AP	F				EG	EG	G		37.2
GL 65	47.1	0	M	M	R	A	RF				EG	EG	GA		31.6
GL 59	45.0	0	Y	MS	RF	AP	F				EG	E	G		33.3
GL 366	43.6	0	M	M	R	A	F				EG	EG	GA		36.7
GL 660	42.9	0	M	M	R	GA	RF				G	EG	GA		32.4
GL R200-95	42.8	0	M	M	R	A	F				GA	EG	GA		34.9
GL 66	41.7	0	M	M	RF	A	RF				EG	EG	GA		30.3
Emerald	40.0	0	M	M	F	AP	F				EG	EG	G		35.6
Gem	38.1	0	M	ML	RF	AP	F				G	EG	GA		34.3
GL 407P	37.8	0	M	M	F	A	F				G	EG	GA		41.7
GL 366A	35.8	0	M	M	RF	A	F				EG	EG	GA		36.0
GL R200	35.5	0	M	M	F	GA	F				EG	EG	GA		33.5
GL 54	34.5	0	M	ML	R	AP	RF				G	EG	GA		31.3
GL 118	33.3	0	M	SM	F	AP	R				E	EG	EG		30.9
Grandeverde	32.7	0	M	ML	F	A	F				G	EG	G		34.6
GL 659	31.9	0	M	SM	R	A	R				EG	EG	EG		31.0
GL 659G	28.7	0	M	M	R	AP	F				EG	E	EG		29.1
GL A36	28.7	0	M	SM	R	A	RF				EG	EG	G		27.8
GL 407	27.4	0	M	M	F	A	F				G	EG	GA		32.1
Ship	27.0	0	M	M	F	A	F				G	EG	GA		33.0
Wes Pak	26.0	0	M	ML	RF	A	F				EG	EG	G		32.9
GL Regular	23.8	0	M	M	R	A	RF				G	E	G		34.3
Oroverde	20.8	0	M	M	RF	AP	F				G	E	G		29.5
Wes Green	0	0	M	L	-	-	-				-	-	-		-
Imp 749	0	0	M	L	-	-	-				-	-	-		-

See footnotes.

Lettuce Strains in Trial V Grown Near Willcox 17 June to 9 September, 1958.

1 Strain	2 % Mkt.	3 % Bolt	4 Green Color	5 Frame Size	6 Head Shape	7 Wrap or Cover	8 Butt Shape	9 Rib Prom.	10 Core Diam.	11 Core Length	12 Pink Rib	13 Rib Disc.	14 Tip- Burn	15 Russet Spot	16 Wt. 24 Heads
GL Premier	51.8	0.7	YM	ML		GA	R	N	S	16.3	EG	E	E		35.3
GL 659	33.8	0.7	MD	MS		GA	R	N	M	18.5	EG	E	E		39.9
GL A36	33.0	1.9	MD	M		G	R	N	S	16.3	E	E	E		30.0
GL 13	31.2	1.8	MD	M		P	R	M	MS	15.8	G	E	E		32.1
GL 659G	27.8	1.9	D	M		G	R-F	MN	M	12.9	EG	E	E		35.5
GL 66	25.0	2.7	M	M		G	R-F	N	MS	14.9	EG	E	E		32.4
GL 660	23.8	0	M	M		G	R	N	M	17.2	EG	EG	E		33.6
GL 118	20.0	1.1	M	ML		G	F	N	M	15.1	EG	E	E		32.5
GL Regular	12.5	7.5	M	ML		GA	R	AN	M	4.9	EG	E	E		32.4
GL 65	13.2	0	M	SM		GA	R	AN	S	5.2	E	E	E		27.2
GL 59	17.7	3.9	M	SM		GA	RF	AN	ML	7.0	E	E	E		38.3
GL 366	17.4	14.1	MD	M		G	H	AN	ML	6.9	E	E	E		34.0
Emerald	22.8	6.9	YM	M		A	R	AN	M	9.0	E	E	E		34.9
GL 407	17.4	5.9	MD	ML		G	R	AN	M	6.9	E	E	E		34.8
Gem	22.4	10.7	M	M		A	R	AN	SM	8.8	E	E	E		32.1
GL 407P	17.8	12.6	YM	ML		A	R	AN	M	7.0	E	E	E		29.2
Oroverde	14.0	5.6	M	SM		A	R	AN	SM	5.5	EG	E	E		27.1
GL 428	17.2	2.2	YM	M		G	R	N	M	6.8	E	E	E		29.2
Wes Pak	15.8	0.8	MD	ML		GA	R	AN	SM	6.2	E	E	E		27.6
Grandeverde	22.3	17.0	M	ML		GA	RF	A	ML	8.8	E	E	E		37.6
GL R200	20.0	8.3	M	ML		G	R	N	M	7.9	E	E	E		31.6
GL 366A	21.0	8.8	M	ML		GA	R	N	M	8.3	E	E	E		30.7
GL R200-95	27.6	9.6	M	ML		A	R	N	M	10.9	E	E	E		37.4
GL 54	12.3	13.3	MD	SM		A	R	AN	S	4.9	E	E	E		25.4
GL Shipp	-	22.9	M	SM		A	R	N	S	-	-	E	E		39.8
Wes Green	-	100.	YM	-		-	-	-	-	-	-	-	-		-
Imp 749	-	100.	M	-		-	-	-	-	-	-	-	-		-

See footnotes.

Lettuce Strains in Trial VI Grown Near Willcox 8 June to 16 September, 1958.

1 Strain	2 % Mkt.	3 % Bolt	4 Green Color	5 Frame Size	6 Head Shape	7 Wrap or Cover	8 Butt Shape	9 Rib Prom.	10 Core Diam.	11 Core Length	12 Pink Rib	13 Rib Disc.	14 Tip- Burn	15 Russet Spot	16 Wt. 24 Heads
GL Premier	65.7	2.3	YM	ML	RF	A	RF	MN	M	14.0	E	G	EG		39.7
GL 659	64.7	0.3	M	MS	R	AP	RF	MN	M	13.3	EG	G	E		45.6
GL 428	63.3	1.4	M	M	RF	GA	RF	MN	M	15.6	E	G	EG		41.3
GSA	63.1	0.4	MD	ML	R	G	RF	MN	M	9.2	E	E	EG		39.1
GL 659G	57.7	0.7	M	M	R	A	R	M	ML	16.2	E	EG	E		46.8
Emerald	55.6	2.9	M	ML	R	G	RF	M	SM	19.7	E	G	EG		41.0
GL 59	55.3	1.0	M	M	RF	A	RF	MN	ML	14.8	E	EG	EG		42.4
GL A36	48.2	2.1	YM	M	R	A	RF	MN	M	15.9	E	EG	E		34.2
GL 65	47.5	0.3	M	M	R	A	R	MN	M	15.8	E	EG	E		39.5
GL 118	45.9	2.7	M	ML	R	G	RF	MN	M	18.3	EG	EG	E		36.1
GL R200	43.6	0.3	M	SM	R	G	RF	AK	ML	19.8	E	EG	E		45.4
GL 66	42.9	2.0	M	M	R	G	RF	AN	M	17.3	E	EG	E		38.0
GL 366	42.7	1.7	M	M	R	A	RF	AN	M	17.6	E	E	E		38.4
GL 13	42.6	0.7	YM	ML	RF	AP	RF	AN	M	18.3	E	G	E		40.8
GL 407P	40.9	3.1	M	M	R	AP	RF	A	ML	20.0	EG	E	E		36.9
Wes Pak	40.1	0	M	M	R	AP	RF	AN	M	13.8	E	EG	E		40.7
GL 660	39.4	3.0	M	M	R	A	RF	AN	M	19.0	E	EG	E		42.3
Gem	39.4	4.2	YM	M	RF	AP	RF	AN	M	21.1	E	EG	E		43.0
GL 366A	39.2	5.1	M	M	R	G	RF	AN	M	18.5	E	E	E		35.3
GL 407	38.5	3.5	M	SM	R	GA	F	AN	ML	17.8	E	E	E		36.9
GSB	37.2	1.0	MD	M	R	AP	RF	AN	SM	12.8	E	E	G		40.4
Grandeverde	37.0	5.7	M	ML	R	AP	RF	A	M	20.1	E	EG	EG		38.6
GL R200-95	36.2	1.5	M	SM	R	AP	R	AN	M	18.1	E	EG	E		36.7
GL Regular	35.4	2.2	M	M	R	A	RF	AN	ML	21.3	EG	E	E		45.1
Oroverde	33.1	1.5	YM	M	RF	A	R	AK	ML	18.2	E	E	E		41.0
Shippers	29.2	4.2	M	SM	R	AP	RF	AN	M	22.2	E	EG	E		43.2
GL 54	27.9	4.5	M	M	R	AP	R	AN	M	19.4	E	E	E		36.2
Wes Green	0	90.1	MD	ML	-	-	-	-	-	-	-	-	-		-
Imp 749	0	86.5	M	ML	-	-	-	-	-	-	-	-	-		-

See footnotes.

Lettuce Strains in Trial VII Near Willcox 31 July to 13 October, 1958.

1 Strain	2 % Mkt.	3 % Bolt	4 Green Color	5 Frame Size	6 Head Shape	7 Wrap or Cover	8 Butt Shape	9 Rib Prom.	10 Core Diam.	11 Core Length	12 Pink Rib	13 Rib Disc.	14 Tip- Burn	15 Russet Spot	16 Wt. 24 Heads
GSA	84.0	0	MD	M	R	G	RF	MN	ML	9.4	E	E	EG		60.9
GL 428	78.9	0	M	M	F	GA	F	MN	ML	14.1	EG	E	EG		60.7
GSC	76.0	0	M	M	R	G	RF	MN	M	6.8	E	E	G		45.5
GL Premier	75.6	0.3	M	SM	R	GA	RF	MN	M	14.0	EG	E	E		53.0
Emerald	74.9	1.5	M	ML	R	G	RF	N	M	14.0	E	E	E		50.8
GSB	73.9	0	M	M	R	G	F	MN	SM	8.8	E	E	EG		48.9
GL 59	71.3	1.0	M	L	R	G	RF	M	SM	15.4	E	E	E		44.6
GL 659	70.4	0.7	M	M	R	P	R	M	SM	10.6	EG	E	E		53.9
GL R200-95	68.6	0.4	M	L	R	G	RF	K	L	11.6	E	E	E		52.5
GL 407P	68.1	0	M	ML	R	GA	R	MN	L	15.7	EG	E	E		51.0
GL 660	66.0	1.5	M	M	R	G	R	AN	ML	11.2	EG	E	E		49.0
GL 118	65.0	1.5	M	ML	R	A	R	K	L	15.6	EG	E	E		46.8
Gem	64.1	0	YM	L	R	G	RF	AN	M	12.1	EG	E	E		46.5
GL A36	63.6	0.3	M	SM	F	A	R	K	ML	11.1	EG	E	E		54.4
GL 65	63.0	0	M	SM	R	G	R	A	ML	9.7	E	E	E		42.8
GL 366	62.7	1.1	M	ML	R	G	RF	K	ML	10.1	E	E	E		45.8
Oroverde	62.0	1.2	M	M	R	G	R	K	M	11.1	E	E	E		40.6
Grandeverde	61.0	0.7	YM	L	R	GA	RF	A	ML	23.4	EG	E	E		62.4
GL 13	60.5	0	YM	M	R	G	R	A	ML	9.4	EG	E	E		43.3
GL 366A	60.2	1.1	M	M	F	G	RF	A	L	15.3	E	E	E		48.7
GL 54	60.2	2.0	M	L	R	G	RF	K	L	16.9	EG	E	E		51.1
GL 407	59.8	0.7	M	M	R	G	RF	AK	ML	11.1	EG	E	E		42.4
GL 659G	58.9	0.7	M	S	R	A	R	AN	MS	10.8	EG	E	E		49.8
GL Regular	57.9	0.7	M	M	R	A	RF	AK	ML	8.8	E	E	E		41.8
GL 66	57.2	0.7	M	M	R	A	RF	AN	M	8.4	E	E	E		42.1
GL R200	55.8	0.4	M	L	R	G	R	AK	ML	11.7	E	E	E		47.7
Wes Pak	52.9	0	MD	M	R	G	RF	A	M	8.6	E	E	E		43.7
Shippers	52.5	2.1	YM	L	R	GA	R	A	ML	14.7	EG	E	E		49.9

See footnotes.

Lettuce Strains in Trial VIII Near Yuma 3 November 1958 to 3 March, 1959.

1 Strain	2 % Mkt.	3 % Bolt	4 Green Color	5 Frame Size	6 Head Shape	7 Wrap or Cover	8 Butt Shape	9 Rib Prom.	10 Core Diam.	11 Core Length	12 Pink Rib	13 Rib Disc.	14 Tip- Burn	15 Russet Spot	16 Wt. 24 Heads
Emerald	82.8	0	YM	M	R	AP	RF			3.5	E	E	E	G	38.1
GL 428	78.8	0	YM	SM	RF	AP	F			3.8	E	E	E	E	39.6
GL Premier	73.8	0	YM	M	R	AP	R			4.0	E	E	E	EG	34.5
GSC	73.5	0	M	ML	R	GA	RF			3.6	EG	E	E	G	38.9
GL 59	71.1	0	YM	SM	R	P	RF			4.1	E	E	E	E	39.0
Imp 749	69.5	0	M	M	R	GA	R			3.9	E	E	E	GA	33.1
Climax	66.3	0	MD	ML	R	GA	RF			3.9	EG	E	E	EG	45.2
GL A36	63.1	0	YM	M	R	AP	RF			3.5	EG	E	E	EG	35.1
GSD	62.9	0	M	ML	R	G	R			3.4	EG	E	E	G	39.2
Gem	62.9	0	M	M	RF	A	R			3.6	E	E	E	EG	41.0
GL 407	62.3	0	M	M	R	GA	R			3.7	E	E	E	E	39.1
GL 407P	61.0	0	M	SM	R	GA	R			2.9	E	E	E	EG	31.9
TBR C	60.0	0	M	SM	R	A	R			2.8	E	E	E	GA	30.4
Merit	60.0	0	YM	M	R	GA	RF			3.8	E	E	E	G	37.4
TBR D	59.8	0	M	SM	R	GA	RF			2.8	EG	E	E	G	33.0
Shippers	59.8	0	YM	M	R	AP	R			3.4	E	E	E	EG	32.0
Oroverde	58.7	0	YM	M	RF	A	CR			3.5	E	E	E	EG	34.3
Grandeverde	58.7	0	M	SM	RF	A	RF			3.6	EG	E	E	EG	39.6
GL 366	57.9	0	M	SM	R	A	R			3.5	E	E	E	G	34.8
GL 118	57.6	0	M	SM	R	A	R			4.5	EG	E	E	E	38.7
Wes Green	55.9	0	MD	L	R	GA	R			4.6	E	E	E	EG	40.6
Vanguard	54.8	0	MD	L	R	GA	RF			4.1	E	E	E	EG	43.4
GL R200	54.4	0	M	SM	RF	A	R			3.6	E	E	E	EG	33.5
GL 13	54.3	0	M	M	RF	A	R			3.3	EG	E	E	EG	35.2
GSB	54.0	0	M	M	R	AP	R			3.6	E	E	E	EG	39.9
GL 54	53.5	0	YM	SM	R	AP	R			3.6	EG	E	E	E	38.0
GL Regular	53.0	0	M	M	R	A	CR			3.6	E	E	E	E	38.1
GL 66	52.5	0	M	SM	R	GA	R			3.7	EG	E	E	E	34.3
GL 660	51.7	0	YM	SM	RF	A	R			3.6	E	E	E	E	33.3
GL 366A	50.9	0	YM	SM	R	GA	R			3.1	E	E	E	EG	30.6
GL 65	49.5	0	M	M	R	A	R			4.1	EG	E	E	EG	39.9
GL 659	47.5	0	YM	M	R	A	CR			3.4	E	E	E	EG	32.8
GL R200-95	46.2	0	MD	M	R	A	R			3.6	EG	E	E	E	33.2
GSA	43.4	0	MD	ML	R	G	RF			3.5	E	E	E	EG	37.9
GL 659G	38.2	0	M	SM	R	GA	CR			3.1	E	E	E	EG	31.6
Wes Pak	27.8	0	D	ML	R	GA	CR			3.8	E	E	E	EG	40.8

See footnotes.

Lettuce Strains in Trial IX Grown Near Yuma 26 November 1958 to 19 March, 1959.

1 Strain	2 % Mkt.	3 % Bolt	4 Green Color	5 Frame Size	6 Head Shape	7 Wrap or Cover	8 Butt Shape	9 Rib Prom.	10 Core Diam.	11 Core Length	12 Pink Rib	13 Rib Disc.	14 Tip- Burn	15 Russet Spot	16 Wt. 24 Heads
GL Premier	88.8	0	Y	M		P	R	M	L	5.3	G	EG	E	E	53.2
GL 407	88.5	0	M	M		P	R	K	L	3.9	G	EG	E	E	50.0
GL 428	86.9	0	YM	M		P	R	N	M	4.4	EG	E	E	E	50.0
Vanguard	85.5	0	M	ML		A	R	M	L	4.6	EG	E	E	E	49.2
GL 59	83.9	0	YM	M		A	R	M	L	4.2	EG	E	E	E	52.5
GL 660	83.7	0	M	M		A	R	K	L	4.0	EG	EG	E	E	48.5
Climax	83.5	0	MD	ML		G	R	M	L	3.5	G	E	E	E	50.8
GSC	83.2	0	M	ML		GA	R	M	L	3.6	EG	E	E	E	50.8
GL 54	82.4	0	M	M		A	R	K	L	4.3	GA	E	E	E	52.5
TBR D	81.3	0	M	M		GA	R	K	L	3.8	G	E	E	E	48.1
Merit	81.1	0	YM	SM		AP	R	M	L	4.2	E	E	E	EG	46.8
GL 13	80.5	0	M	M		A	RF	M	ML	4.0	G	EG	E	E	48.4
GSD	80.3	0	M	ML		GA	R	M	ML	3.7	EG	E	E	E	52.2
Gem	80.2	0	M	M		AP	R	MN	ML	3.9	G	E	E	E	47.3
GSA	80.2	0	M	M		GA	RF	M	ML	4.0	G	EG	E	E	48.4
TBR C	80.0	0	YM	M		A	R	MN	ML	3.8	EG	E	E	E	48.2
GL 118	79.5	0	M	M		AP	R	M	ML	3.9	EG	EG	E	E	45.3
GL 407P	77.9	0	M	SM		A	R	MN	M	3.6	G	E	E	E	46.2
GSB	77.4	0	M	SM		AP	R	N	SM	4.3	EG	E	E	E	49.5
GL 659	77.0	0	MD	M		GA	R	N	ML	3.7	G	E	E	E	48.5
Emerald	76.3	0	YM	M		A	R	M	ML	4.2	EG	EG	E	E	52.9
Oroverde	75.9	0	YM	M		AP	R	M	ML	4.2	G	E	E	E	50.7
Grandeverde	75.2	0	YM	M		A	R	M	ML	3.9	EG	E	E	E	48.6
GL 66	74.9	0	M	SM		A	R	M	L	3.9	EG	EG	E	E	45.8
GL R200	71.6	0	M	SM		A	R	M	M	3.9	G	E	E	E	47.8
Wes Green	71.5	0	YM	L		G	CR	MK	L	5.7	G	E	E	E	48.5
GL 659G	71.2	0	MD	M		GA	RF	N	ML	3.8	G	E	E	E	49.5
GL 366A	71.1	0	M	SM		A	R	MN	L	3.8	EG	E	E	E	51.2
GL 366	70.6	0	M	SM		A	R	MN	SM	3.6	G	E	E	E	45.4
Shippers	70.6	0	M	SM		A	RF	MN	L	3.8	G	E	E	EG	49.0
GL R200-95	70.5	0	M	M		GA	R	N	M	3.8	EG	E	E	E	47.3
GL A36	68.4	0	YM	SM		AP	R	M	L	3.7	EG	EG	E	E	48.5
Imp 749	67.8	0	Y	ML		G	R	M	L	5.2	EG	E	E	E	45.6
GL 65	67.7	0	M	SM		AP	R	M	L	3.7	EG	EG	E	E	43.9
Wes Pak	66.2	0	MD	ML		G	CR	K	L	3.8	EG	EG	E	E	48.7
GL Regular	62.1	0	M	SM		A	R	M	ML	3.5	EG	E	E	E	45.6

See footnotes.

Lettuce Strains Grown Near Willcox in Trial X 19 January to 19 May, 1959.

1 Strain	2 % Mkt.	3 % Bolt	4 Green Color	5 Frame Size	6 Head Shape	7 Wrap or Cover	8 Butt Shape	9 Rib Prom.	10 Core Diam.	11 Core Length	12 Pink Rib	13 Rib Disc.	14 Tip- Burn	15 Russet Spot	16 Wt. 24 Heads
Climax	73.3	0	YM	M		A	R	M	ML	3.6	E	E	E	E	55.0
GL Premier	70.5	0	YM	M		AP	R	MN	ML	4.3	EG	E	E	E	54.2
Vanguard	66.3	0	YM	ML		AP	R	M	L	4.1	EG	E	E	E	55.1
GL 59	66.0	0	M	M		AP	R	M	M	4.2	EG	E	EG	E	51.5
TBR C	65.5	0	M	M		G	R	M	L	4.3	EG	E	E	E	52.4
GL 118	64.0	0	MD	M		AP	R	M	L	4.0	EG	E	EG	E	50.0
GL 366	64.0	0	M	M		A	R	M	ML	3.8	EG	E	EG	E	47.5
Shippers	63.8	0	MD	M		GA	R	M	L	4.6	EG	E	E	E	54.0
GSD	63.5	0	M	ML		A	R	M	ML	3.5	E	E	E	E	51.4
TBR D	63.5	0	M	M		GA	R	M	ML	4.1	EG	E	E	E	50.4
Merit	63.3	0	MD	M		AP	R	M	L	3.2	E	E	E	E	49.2
GL 407P	62.5	0	MD	M		G	R	M	ML	4.1	EG	E	EG	E	48.0
Emerald	62.0	0	YM	M		AP	R	M	L	4.5	EG	E	EG	E	57.8
Imp 749	62.0	0	YM	M		AP	R	M	L	6.7	EG	E	EG	E	52.8
GL 660	61.5	0	M	M		AP	R	M	M	3.8	E	E	E	E	45.3
Grandeverde	60.5	0	MD	M		A	R	M	ML	4.0	EG	E	E	E	51.1
GL 407	60.3	0	M	M		A	R	MK	L	4.2	EG	E	EG	E	55.6
GL A36	60.3	0	M	M		A	R	MN	ML	3.7	EG	E	EG	E	44.6
GL R200	59.8	0	M	M		A	R	MN	ML	3.5	EG	E	EG	E	48.7
GL 13	59.5	0	M	M		A	R	M	M	3.6	EG	E	EG	E	46.8
GSC	59.0	0	M	ML		AP	R	M	ML	3.5	E	E	EG	E	48.2
GL 66	58.5	0	M	ML		AP	R	M	ML	3.9	E	E	E	E	43.8
GL 428	50.5	0	YM	M		AP	R	M	L	4.9	EG	E	EG	E	56.7
GL 54	58.5	0	D	ML		GA	CR	M	M	4.0	EG	E	G	E	46.3
GSB	58.3	0	M	M		AP	R	M	M	4.0	EG	E	G	E	53.1
GL R200-95	58.0	0	MD	M		A	R	M	ML	3.8	EG	E	E	E	47.1
GSA	58.0	0	M	M		A	R	MN	ML	3.7	EG	E	EG	E	49.6
Gem	57.8	0	M	M		GA	R	M	ML	3.8	EG	E	EG	E	48.8
GL 366A	55.8	0	MD	M		A	R	M	ML	4.0	E	E	EG	E	48.5
Oroverde	54.0	0	M	M		A	R	M	ML	3.9	E	E	E	E	51.3
GL Regular	53.3	0	MD	M		A	R	MK	ML	3.9	E	E	E	E	49.3
GL 659G	50.8	0	MD	M		AP	CR	M	M	3.4	E	E	E	E	43.0
GL 659	49.8	0	D	M		AP	R	M	ML	3.9	EG	E	E	E	51.0
Wes Pak	49.5	0	D	M		A	CR	MK	L	4.6	E	E	E	E	53.2
GL 65	46.5	0	M	M		A	R	M	ML	3.8	E	E	E	E	48.9
Wes Green	21.3	0	M	L		GA	CR	MK	ML	13.2	E	E	G	E	42.2

See footnotes.

Lettuce Strains in Trail XI Grown Near Aguila 23 January to 1 May, 1959.

1 Strain	2 % Mkt.	3 % Bolt	4 Green Color	5 Frame Size	6 Head Shape	7 Wrap or Cover	8 Butt Shape	9 Rib Prom.	10 Core Diam.	11 Core Length	12 Pink Rib	13 Rib Disc.	14 Tip- Burn	15 Russet Spot	16 Wt. 24 Heads
GSD	81.6	0	MD	ML		AP	R	M	SM	2.9	E	E	E	E	32.4
GL Premier	79.9	0	M	M		A	R	MN	M	4.5	EG	E	E	E	38.8
Climax	77.5	0	MD	ML		A	R	M	ML	3.3	EG	E	EG	E	41.5
Merit	74.4	0	MD	SM		A	R	MN	M	3.0	E	E	E	E	32.0
Vanguard	73.0	0	MD	L		GA	R	MN	M	3.5	E	E	EG	E	35.6
Emerald	72.7	0	M	ML		A	-	-	-	-	-	-	-	-	-
GL 428	71.5	0	MD	L		GA	R	MN	SM	3.8	E	E	E	E	33.5
Gem	71.4	0	MD	ML		GA	R	M	M	3.6	E	E	E	E	35.7
GL 59	70.1	0	D	ML		GA	R	M	SM	3.9	E	E	EG	E	34.0
TBR D	69.4	0	MD	M		A	R	M	M	3.9	E	E	E	E	36.6
Grandeverde	67.4	0	MD	SM		AP	R	M	SM	3.5	E	E	E	E	34.0
Oroverde	67.3	0	D	M		A	R	M	M	3.5	EG	E	EG	E	37.5
GL 366	67.0	0	MD	SM		AP	R	MK	M	4.0	E	E	EG	E	39.1
GL 660	66.4	0	D	M		GA	R	M	M	3.7	EG	E	E	E	33.7
TBR C	66.3	0	D	M		A	R	MK	SM	3.3	E	E	E	E	33.5
GSB	66.2	0	D	M		GA	R	MN	SM	3.7	E	E	EG	E	34.6
GL 13	66.2	0	MD	M		A	R	M	M	3.7	E	E	E	E	38.5
GL 407P	64.7	0	MD	M		A	R	M	SM	3.1	E	E	E	E	32.2
GL R200	64.7	0	D	SM		AP	R	M	M	3.4	E	E	E	E	36.0
GL 659	64.4	0	MD	SM		AP	R	M	SM	3.4	EG	E	E	E	39.5
Shippers	63.9	0	D	M		GA	R	M	SM	3.3	E	E	EG	E	35.8
GL 66	63.2	0	MD	ML		GA	R	M	M	3.3	E	E	E	E	30.4
GL 366A	63.1	0	D	SM		A	R	M	SM	2.8	E	E	E	E	32.2
GL A36	62.7	0	MD	M		GA	R	M	SM	3.1	E	E	E	E	31.9
GL 407	61.8	0	D	M		A	R	MK	M	3.2	EG	E	EG	E	36.8
GL R200-95	61.5	0	D	M		A	R	M	M	3.4	E	E	E	E	35.4
GL 659G	59.2	0	MD	SM		AP	R	M	SM	3.1	E	E	E	E	33.8
GL 118	58.8	0	M	M		AP	R	M	M	3.3	E	E	E	E	33.1
GSC	58.0	0	MD	ML		A	R	M	M	2.6	E	E	G	E	30.1
GL Regular	57.1	0	D	M		AP	R	M	SM	2.9	E	E	E	E	31.9
GL 54	56.7	0	D	L		A	R	M	M	3.4	EG	E	G	E	32.0
GSA	55.5	0	MD	ML		A	R	M	M	3.4	E	E	E	E	35.1
Wes Pak	55.4	0	D	ML		AP	R	K	ML	3.6	E	E	EG	E	38.0
GL 65	48.7	0	D	M		GA	R	M	M	3.2	E	E	E	E	30.9
Imp 749	28.2	0	M	L		GA	R	-	-	-	-	-	-	-	-
Wes Green	10.4	0	MD	ML		GA	R	-	-	-	-	-	-	-	-

See footnotes.

Lettuce Strains in Trial XII Grown Near Willcox 6 February to 26 May, 1959.

1 Strain	2 % Mkt.	3 % Bolt	4 Green Color	5 Frame Size	6 Head Shape	7 Wrap or Cover	8 Butt Shape	9 Rib Prom.	10 Core Diam.	11 Core Length	12 Pink Rib	13 Rib Disc.	14 Tip- Burn	15 Russet Spot	16 Wt. 24 Heads
TBR C	64.0	0	M	M		GA	R	M	ML	8.3	E	E	G	E	44.0
GL Premier	62.5	0	YM	M		P	R	MN	M	9.3	G	E	G	E	48.6
GSD	62.3	0	M	ML		A	R	M	L	6.0	EG	E	G	E	49.8
GL 118	59.3	0	M	M		A	R	M	L	8.7	EG	E	GA	E	55.4
GL 59	57.8	0	YM	M		P	R	MN	ML	8.7	EG	E	GA	E	53.8
GL 54	55.5	0	MD	M		GA	R	MK	ML	11.3	EG	E	GA	E	47.7
Emerald	55.0	0	YM	ML		AP	RF	M	M	8.4	EG	E	G	E	45.5
GL 428	54.8	0	YM	M		AP	RF	M	ML	9.3	EG	E	G	E	56.6
GL 660	54.0	0	M	M		A	R	M	ML	6.6	EG	E	G	E	50.4
GL 65	53.8	0	M	M		A	R	MN	M	7.1	EG	E	G	E	41.0
GL 13	53.5	0	MD	ML		A	R	M	M	7.3	EG	E	G	E	49.1
GL R200-95	52.3	0	M	M		A	R	M	L	7.3	EG	E	G	E	52.3
GSB	52.3	0	YM	M		AP	R	M	M	6.3	EG	E	GA	E	55.6
TBR D	52.0	0	M	M		GA	R	M	M	7.3	EG	E	G	E	42.5
Wes Pak	50.3	0	MD	M		A	R	M	ML	11.1	EG	E	G	E	48.3
GL 66	49.5	0	M	M		A	R	MN	M	7.6	EG	E	G	E	41.3
GL 366	49.3	0	M	M		A	R	M	ML	7.9	EG	E	G	E	45.6
GL 407P	48.0	0	M	M		A	R	M	ML	8.2	EG	E	G	E	49.8
Grandeverde	48.0	0	M	SM		A	R	M	ML	6.6	EG	E	G	E	45.4
GL A36	47.8	0	M	SM		A	R	MN	M	6.7	EG	E	G	E	40.6
Shippers	47.5	0	MD	M		GA	R	M	ML	8.2	EG	E	G	E	51.2
GL R200	45.5	0	MD	M		A	R	M	M	9.4	EG	E	GA	E	46.4
Gem	45.3	0	M	M		A	R	M	ML	6.7	EG	E	G	E	48.1
Oroverde	44.0	0	M	M		A	R	M	ML	7.8	EG	E	G	E	49.1
GSA	43.0	0	M	M		AP	RF	M	ML	5.1	EG	E	GA	E	48.2
Merit	42.5	0	MD	SM		AP	RF	M	L	6.1	EG	E	G	E	52.8
GL Regular	42.0	0	MD	M		A	R	M	ML	6.9	EG	E	G	E	45.8
GL 407	42.0	0	M	SM		A	R	M	M	6.5	EG	E	G	E	47.0
GL 366A	42.0	0	M	M		A	R	M	ML	7.3	EG	E	G	E	44.9
GSC	42.0	0	M	M		A	R	M	ML	5.3	EG	E	GA	E	49.0
GL 659	38.5	0	M	SM		AP	R	MN	M	6.4	EG	E	G	EG	46.5
GL 659G	33.8	0	M	SM		AP	R	M	M	6.1	EG	E	G	EG	46.9
Imp 749	23.3	0	M	ML		A	R	M	L	15.7	EG	E	G	E	47.7
Wes Green	0.8	0	M	ML		AP	R	-	-	-	-	-	-	-	-

See footnotes.

Lettuce Strains in Trial XIII Grown Near Willcox 22 February to 2 June, 1959.

1 Strain	2 % Mkt.	3 % Bolt	4 Green Color	5 Frame Size	6 Head Shape	7 Wrap or Cover	8 Butt Shape	9 Rib Prom.	10 Core Diam.	11 Core Length	12 Pink Rib	13 Rib Disc.	14 Tip-Burn	15 Russet Spot	16 Wt. 24 Heads
GL Premier	48.0	0	YM	M		AP	R	K	ML	7.8	EG	E	EG	EG	60.0
GL 59	39.3	0	YM	SM		A	R	MK	ML	6.6	G	E	EG	EG	66.3
GL 366	31.3	0	MD	M		A	R	MK	ML	5.1	G	E	EG	E	67.1
GL 428	30.0	0	YM	M		AP	R	K	ML	6.5	EG	E	EG	EG	63.1
Emerald	29.3	0	YM	M		A	RF	K	L	6.6	EG	E	EG	EG	69.9
TBR D	29.0	0	M	M		A	R	K	M	5.8	G	E	EG	EG	67.1
GL 660	27.5	0	M	M		GA	R	K	L	5.8	EG	E	EG	E	66.8
GL A36	27.3	0	M	M		A	R	MK	M	5.5	EG	E	EG	E	55.5
TBR C	27.3	0	M	M		A	R	MK	ML	5.2	EG	E	EG	E	63.1
R200-95	25.0	0	M	M		A	R	MK	ML	4.8	EG	E	EG	E	57.7
GL 13	25.0	0	M	SM		A	R	K	L	5.6	EG	E	EG	E	67.6
GL 407P	24.3	0	M	M		A	R	K	L	5.7	EG	E	EG	E	60.1
GL R200	24.3	0	M	M		A	R	MK	M	5.0	EG	E	E	E	49.5
GSD	24.3	0	M	ML		A	R	MK	ML	4.7	EG	E	EG	E	66.6
GL 65	23.5	0	YM	SM		A	R	MK	ML	5.2	EG	E	EG	E	61.6
Gem	23.5	0	M	SM		A	R	MK	ML	6.6	EG	E	EG	E	60.1
GL 659G	23.0	0	MD	SM		AP	R	MK	M	4.8	EG	E	E	E	56.9
GSA	23.0	0	M	SM		A	RF	MK	L	6.0	G	E	G	E	60.2
Grandeverde	22.5	0	M	M		A	R	MK	L	5.3	EG	E	EG	E	66.3
GL 659	21.5	0	MD	SM		AP	R	MK	M	5.0	EG	E	EG	E	62.0
Merit	21.5	0	MD	S		A	RF	MK	L	4.8	E	E	G	E	63.8
GL 118	21.3	0	M	S		AP	R	MK	ML	6.4	EG	E	EG	E	63.6
GL 366A	21.3	0	M	M		A	R	MK	ML	4.9	EG	E	EG	E	59.7
Shippers	20.5	0	MD	M		GA	R	MK	M	4.6	EG	E	EG	E	56.2
GL 66	19.5	0	M	SM		A	R	MK	L	5.4	E	E	E	E	58.1
GL 54	19.5	0	M	M		GA	R	K	L	6.4	G	E	GA	E	71.3
Wes Pak	19.0	0	MD	M		AP	R	K	L	6.3	E	E	EG	E	62.7
GL Regular	18.5	0	M	S		A	R	MK	M	5.7	EG	F	EG	E	59.1
GSB	17.3	0	MD	M		A	R	MK	M	6.1	EG	E	GA	E	66.9
Oroverde	16.5	0	M	SM		AP	R	MK	ML	5.8	EG	E	EG	E	67.4
GSC	15.8	0	M	SM		A	R	MK	ML	4.9	E	E	GA	E	63.5
Phoenix	15.8	0	M	M		A	R	MK	ML	5.1	EG	E	EG	E	59.1
GL 407	15.3	0	M	M		A	R	K	L	5.2	EG	E	EG	E	62.7
Primaverde	14.0	0	M	S		AP	R	MK	L	5.1	EG	E	EG	E	61.1
Climax	9.8	0	YM	M		AP	R	K	L	5.6	EG	E	A	E	62.4
Imp 749	9.3	0	YM	M		A	R	MK	ML	-	-	-	-	-	-
Vanguard	8.3	0	M	ML		A	R	MK	-	-	-	-	-	-	-
Wes Green	1.3	0	M	L		A	R	MK	-	-	-	-	-	-	-

See footnotes.

Lettuce Strains in Trial XIV Grown Near Aguila 28 February to 20 May, 1959.

1 Strain	2 % Mkt.	3 % Bolt	4 Green Color	5 Frame Size	6 Head Shape	7 Wrap or Cover	8 Butt Shape	9 Rib Prom.	10 Core Diam.	11 Core Length	12 Pink Rib	13 Rib Disc.	14 Tip- Burn	15 Russet Spot	16 Wt. 24 Heads
GL Premier	57.8	0	YM	M		AP	RF	M	SM	5.2	G	E	EG	E	41.9
Vanguard	54.8	0	MD	ML		A	R	M	ML	6.2	EG	E	EG	EG	43.6
GL 13	51.5	0	M	M		GA	R	M	SM	4.0	EG	E	EG	E	38.9
GSD	44.5	0	MD	ML		A	R	M	SM	3.6	EG	E	EG	E	39.6
TBR D	44.5	0	M	M		GA	R	M	SM	3.8	EG	E	EG	EG	36.0
Gem	44.3	0	M	M		A	R	M	SM	3.6	EG	E	EG	EG	39.7
GL 660	43.0	0	M	M		A	CR	M	SM	3.7	EG	E	EG	E	42.3
Merit	42.3	0	MD	SM		A	R	M	ML	3.6	EG	E	EG	EG	37.5
TBR C	41.5	0	M	M		GA	R	M	M	4.0	EG	E	E	E	40.2
GSB	41.0	0	M	SM		AP	CR	M	SM	4.6	EG	E	EG	E	39.0
GL 407	40.8	0	M	M		A	R	M	SM	4.5	EG	E	EG	E	42.6
Emerald	40.5	0	M	M		A	RF	M	SM	5.0	G	E	EG	EG	42.1
GL 59	40.3	0	M	M		A	R	MN	SM	4.3	EG	E	EG	EG	41.4
GL 366	39.5	0	MD	M		A	CR	M	M	4.0	EG	E	EG	E	41.1
GL 407P	39.3	0	M	M		GA	CR	M	SM	3.7	EG	E	EG	E	36.0
GSA	38.5	0	M	M		GA	RF	M	M	4.1	EG	E	EG	E	38.1
GL 118	38.3	0	M	M		A	R	M	M	4.7	EG	E	EG	E	47.9
GL A36	37.5	0	M	SM		A	R	MN	SM	3.4	EG	E	E	E	32.7
GL 428	36.0	0	YM	SM		A	RF	MN	SM	4.5	EG	E	EG	E	42.3
GL R200	36.0	0	M	M		A	R	M	M	3.7	EG	E	E	E	35.7
Grandeverde	36.0	0	MD	M		A	CR	M	M	4.3	G	E	EG	EG	45.5
Wes Pak	34.8	0	M	M		A	CR	MK	SM	3.9	EG	E	E	E	41.9
Shippers	34.5	0	M	SM		A	CR	M	M	3.9	EG	E	E	EG	40.8
GL 66	34.3	0	M	M		A	R	MN	SM	3.7	EG	E	EG	E	35.6
Oroverde	33.5	0	M	SM		A	R	M	M	3.6	E	E	EG	E	38.4
GL R200-95	32.0	0	YM	M		AP	CR	M	SM	3.6	EG	E	E	E	38.1
GSC	31.0	0	M	M		A	R	MN	M	3.5	EG	E	G	E	42.7
Climax	30.5	0	YM	M		AP	R	M	ML	4.7	EG	G	EG	EG	42.8
GL Regular	30.3	0	MD	SM		A	CR	M	SM	3.4	EG	E	E	E	32.8
GL 54	29.8	0	MD	M		A	CR	MK	ML	4.1	EG	E	G	E	43.2
GL 366A	28.3	0	M	SM		AP	CR	M	SM	3.3	EG	E	E	E	35.5
GL 659	27.0	0	M	S		AP	CR	MN	SM	3.8	EG	E	EG	EG	42.9
GL 65	25.8	0	M	SM		A	R	MN	SM	3.6	EG	E	E	E	32.7
GL Primaverde	25.5	0	M	SM		AP	CR	MN	SM	3.2	EG	E	E	E	40.9
GL 659G	22.8	0	M	S		AP	R	MN	SM	3.5	EG	E	E	E	37.5
Imp 749	22.0	0	YM	ML		A	-	-	-	-	-	-	-	-	-
GL Phoenix	13.5	0	M	S		AP	CR	M	SM	4.2	EG	E	E	E	38.0
Wes Green	.3	0	M	ML		A	-	-	-	-	-	-	-	-	-

See footnotes.

Lettuce Strains in Trial XV Grown Near Willcox 19 March to 16 June, 1959.

1 Strain	2 % Mkt.	3 % Bolt	4 Green Color	5 Frame Size	6 Head Shape	7 Wrap or Cover	8 Butt Shape	9 Rib Prom.	10 Core Diam.	11 Core Length	12 Pink Rib	13 Rib Disc.	14 Tip- Burn	15 Russet Spot	16 Wt. 24 Heads
GL 428	59.0	0	M	ML		A	RF	M	M	5.5	EG	E	A	EG	47.9
TBR D	48.5	0	MD	M		GA	R	MK	ML	5.0	EG	E	A	E	47.4
Merit	48.0	0	MD	ML		AP	RF	M	L	4.2	EG	E	A	EG	45.9
GL 407P	45.0	0	M	M		A	R	MK	ML	5.6	EG	E	A	E	53.2
GL Premier	43.5	0	YM	M		AP	RF	MN	SM	5.2	EG	EG	GA	EG	35.1
GL 366	40.0	0	M	M		A	R	M	M	4.2	EG	E	A	G	48.9
GL 118	39.3	0	M	M		A	R	M	M	3.8	E	E	A	E	38.8
Wes Pak	39.0	0	MD	M		A	R	M	S	4.2	EG	E	A	E	33.9
Grandeverde	38.8	0	M	ML		A	R	M	ML	3.9	E	E	A	E	42.1
GL 59	37.5	0	YM	M		A	RF	M	M	4.5	EG	E	GA	E	42.8
Emerald	37.5	0	YM	M		A	RF	M	M	4.7	E	E	GA	E	41.9
GL R200	35.3	0	M	ML		A	R	M	M	4.5	E	E	A	E	43.7
TBR C	33.8	0	M	M		GA	R	M	M	3.9	E	E	A	E	37.6
GL 659	32.8	0	M	SM		AP	R	MN	SM	3.5	EG	E	A	E	41.6
GL 407	32.8	0	M	ML		A	R	M	SM	3.9	EG	E	A	EG	38.0
Oroverde	31.8	0	M	M		A	R	MK	ML	4.4	E	E	A	E	48.6
GL 660	30.5	0	M	M		A	R	M	M	4.0	E	E	A	E	37.0
GSC	30.5	0	M	M		A	R	M	ML	4.4	EG	E	AP	A	42.5
Primaverde	30.3	0	M	M		AP	R	M	M	4.0	EG	E	AP	E	42.1
Shippers	30.0	0	M	M		A	R	M	ML	4.1	EG	E	A	G	39.2
Gem	29.8	0	M	M		A	R	M	M	4.4	EG	E	A	E	38.9
GSD	29.8	0	M	ML		A	RF	M	M	4.1	EG	E	A	G	40.9
GL 13	29.3	0	M	M		A	R	M	M	4.2	EG	E	A	EG	40.4
GL 66	28.3	0	M	M		AP	R	M	SM	4.4	E	E	A	E	37.0
GL 366A	27.0	0	M	M		A	RF	M	M	3.8	E	E	A	E	39.4
GSA	27.0	0	MD	SM		AP	RF	M	ML	4.6	E	E	AP	EG	43.6
GL Regular	25.5	0	M	M		A	R	M	M	3.9	E	E	A	E	36.4
GL R200-95	25.3	0	M	M		A	R	M	M	3.6	EG	E	A	E	36.9
GL 659G	24.3	0	YM	SM		A	R	M	M	3.7	EG	E	A	E	45.8
GL A36	23.5	0	M	M		AP	R	M	M	4.4	EG	E	AP	EG	37.3
GSB	20.5	0	MD	M		AP	R	M	SM	4.2	EG	E	A	G	40.0
GL 54	20.3	0	M	M		A	CR	M	ML	4.6	EG	E	A	E	40.9
Climax	19.5	0	MD	L		AP	CR	M	ML	6.1	EG	E	AP	EG	47.9
GL Phoenix	17.5	0	M	SM		AP	R	MN	SM	4.2	E	E	AP	E	38.7
GL 65	16.3	0	M	SM		A	R	MN	M	3.8	E	E	A	E	33.6
Imp 749	11.8	0	M	ML		AP	-	-	-	-	-	-	-	-	-
Wes Green	.8	0	D	L		A	-	-	-	-	-	-	-	-	-

See footnotes.

FOOTNOTES

1. Strain designation - refer to strain list.

2. Percent of heads ready for harvest during a ten-day period. Strains listed above solid line are not statistically different in this category.

3. Percent of plants showing visible evidence of bolting.

4. Judgment of plant color; Y = yellowish, M = medium, D = dark.

5. Size of plant; S = small, M = medium, L = large.

6. Head shape; R = round (nearly spherical), F = flattened somewhat.

7. Degree to which head was protected by first cap leaf and frame leaves, also judgment of appearnace; G = good, A = average, P = poor.

8. General shape of the butt as it appears in a packed carton; R = rounded, F = flat, H = hollow or depressed, C = cone-shape or pointed.

9. Size and appearance of midribs on the lettuce butt; N = thin, M = medium, K = thick.

10. Judgment on size of core showing after trimming for field pack; S = small, M = medium, L = large.

11. Actual average measurement of core (stem) length within the lettuce head. Figure given in centimeters (2.54 cm = 1 inch). Cores bent over or twisted within the head sometimes gave measurements in excess of head heights.

12. Freedom from pink rib rated after 7 to 14 days under conditions of simulated shipping and storage; E = excellent, G = good, A = average, P = poor.

13. Freedom from rib discoloration rated after 7 to 14 days under conditions of simulated shipping and storage; E = excellent, G = good, A = average, P = poor.

14. Freedom from tipburn rated after 7 to 14 days under conditions of simulated shipping and storage; E = excellent, G = good, A = average, P = poor.

15. Freedom from russet spotting rated after 7 to 14 days under conditions of simulated shipping and storage; E = excellent, G = good, A = average, P = poor.

16. Actual average weight in pounds of lettuce trimmed for field pack.